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KEY

TO

RAUB'S

COMPLETE ARITHMETIC.

BY

ALBERT N. RAUB, A.M.,

PRINCIPAL OF CENTRAL STATE NORMAL SCHOOL, LOCK HAVEN, PA., AND
AUTHOR OF RAUB'S "ARITHMETICS," RAUB'S "READERS,"
"PLAIN EDUCATIONAL TALKS," ETC.

PORTER & COATES,
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PREFACE.

THE plan of this Key is such as to need but little explanation. The solutions will be found numbered and paged to correspond with the problems in the *Complete Arithmetic.* In some cases suggestions only are given, in preference to full solutions.

The Author would advise that those who use the Key use it as little as possible in the way of gaining help. They should use it rather in the way of comparing their own solutions with those in the book. In this manner it may be useful to either teacher or pupil, just as an instructor is useful in giving hints or verifying solutions and results.

A. N. R.

STATE NORMAL SCHOOL,
LOCK HAVEN, PA.,
JAN. 1, 1879.

KEY

TO

RAUB'S COMPLETE ARITHMETIC.

ADDITION.

PAGE 23.

The answers only to these questions are given :

(19.) 940932.
(20.) 1129236.
(21.) 1114330.
(22.) 872926.
(23.) 16301.
(24.) 16376.
(25.) 13312.
(26.) 12422.
(27.) 14079.

(28.) $6420 = A's.
5130 = B's.
11550 = C's.
$23100 = All.

(29.) $3500 = Cost of house.
7800 = " " farm.
11300 = " " store.
14800 = " " mill.
$37400 = " " all.

(30.) 327 miles.
462 "
194 "
983 miles. Distance E.

349 miles.
621 "
347 "
1317 miles. Distance W.

983 mi. + 1317 miles = 2300 miles. *Ans.*

(32.) 21 degrees below.
105 " above.
126 degrees = Difference.

(33.) 911 miles E. of Chicago.
401 " W. of Chicago.
1312 miles = Dis. apart.

(34.) 1312 miles E. of Omaha.
1961 " W. of Omaha.
3273 miles = Dis. from New York to San Francisco.

(35.) $5500, Wife's.

$$\left.\begin{array}{r}3200\\3200\\3200\\3200\end{array}\right\}\text{Each son.}$$

$$\left.\begin{array}{r}2800\\2800\\2800\end{array}\right\}\text{Each daughter.}$$

1950, Church.
2430, School.
$31080 = Estate.

SUBTRACTION.

PRACTICAL PROBLEMS, PAGE 30.

(9.) $6720, Farm.
3740, House.
10160, Store.
$20620 = Cost of all.
$25000 – $20620 = $4380 = Gain.

(10.) $900
1205
$2105. Income.
$2105 – $1425 = $680. *Ans.*

(11.) $1200
325
220
$1745
$2500 – $1745 = $755. *Ans.*

(12.) $7334
8627
$15961 – $12500 = $3461. *Ans.*

(13.) 225
217

640 − 442 = 198. Remainder.
500 − 198 = 302. *Ans.*

(14.) 720 lbs. 327 lbs.
617 " 445 "
1337 lbs. 772 lbs. Amt. sold.
1337 lbs. − 772 lbs. = 565 lbs. *Ans.*

MULTIPLICATION.

PRACTICAL PROBLEMS, PAGE 37.

(17.) 91 miles + 85 miles = 176 miles, distance they approach each other in one day.
24 × 176 miles = 4224 miles.
4500 miles − 4224 miles = 276 miles. *Ans.*

(18.) 75 miles + 85 miles = 160 miles, distance they recede from each other in one day.
15 × 160 miles = 2400 miles. *Ans.*

(19.) 204 miles − 127 miles = 77 miles, distance gained in 1 day.
9 × 77 miles = 693 miles. *Ans.*

DIVISION.

PAGE 40.

19. If they hire the horse out for 25 days at 4 dollars a day, they receive 25 times 4 dollars, or 100 dollars; if they sell him for 120 dollars, they receive altogether 100 dollars and 120 dollars, or 220 dollars; hence, they gain on the horse 220 dollars minus 160 dollars, which is 60 dollars, or 12 dollars each.

20. The clothes, hat, and shoes cost him 25 dollars, 6 dollars, and 4 dollars respectively, which are 35 dollars. He has remaining 100 dollars minus 35 dollars, or 65 dollars, for which he can buy as many books at 5 dollars each as 5 is contained times in 65, or 13 books.

21. 100 dollars + 20 dollars equals 120 dollars. If he sells 15 barrels of flour for 120 dollars, he receives for each barrel as many dollars as 15 is contained times in 120, or 8 dollars.

22. Answer, 13.

23. 40 pigs at 7 dollars each are worth 280 dollars. If a farmer has 40 pigs, and keeps 5, he sells the difference between 40 and 5, or 35. If he receives 280 dollars for 35 pigs, he receives for 1 pig as many dollars as 35 is contained times in 280, or 8 dollars.

PRACTICAL PROBLEMS. PAGE 44.

(16.) $48 \times \$43 = \$2064$. Val. of cows.
$2064 \div 16 = 129$. *Ans.*

(17.) $123 \times \$117 = \$14391$. Val. of land.
$14391 \div 39 = 369$. *Ans.*

(18.) $\$8000 - \$4500 = \$3500$;
$\$3500 \div \$140 = 25$. *Ans.*

(20.) $107100 \div 42 = 2550$;
$2550 \div 34 = 75$. *Ans.*

SUBTRACTION OF U. S. MONEY.

PAGE 53.

(8.)

$$\begin{array}{r} \$15965.27 \\ 5000.00 \\ 4000.00 \\ \hline \$24965.27 \end{array} = \text{Cost of all.}$$

$\$27000 - \$24965.27 = \$2034.73$. *Ans.*

(9.) $325.
647.25
265.17
27.50
127.15
315.62
$2000 − $1707.69 = $292.31. *Ans.*

MULTIPLICATION OF U. S. MONEY.

PAGE 54.

(8, *Oral.*) 5 pounds of coffee at 35 cents a pound will cost $1.75, and 12 pounds of ham at 22 cents a pound will cost $2.64; the cost of both is $1.75 and $2.64, or $4.39. I will get as much change from a 5-dollar bill as the difference between 5 dollars and 4 dollars 39 cents, which is 61 cents.

(8, *Written.*) 25 × $37.25 = $931.25
15 × 6.15 = 92.25
12 × 72.20 = 866.40
$1889.90. *Ans.*

(9.) 12 × $125 = $1500. Clerk hire.
12 × 27.25 = 327. Rent.
1110.15
$5000 − $2937.15 = $2062.85. *Ans.*

(10.) 15 × 63 gal. = 945 gallons.
$1.10 − $.95 = $.15, gain on 1 gallon.
945 × $.15 = $141.75. *Ans.*

DIVISION OF U. S. MONEY.

PAGE 55.

(10, *Oral.*) 3 yards of cloth at $2.50 a yard cost $7.50. $7.50 and $8 are $15.50. If I give a $20-bill, I receive as change $20 minus $15.50, or $4.50; and at 75 cents each I can buy as many hats as 75 cents is contained times in $4.50, or 6 hats.

PAGE 56.

(13.) 250 × $.37 = $92.50. Selling price.
$92.50 − $82.50 = $10. *Ans.*

(14.) 47 × $40.50 = $1903.50. Selling price.
$1903.50 − $1750.75 = $152.75. *Ans.*

(16.) 48 × $2.50 = $120. Value of cloth.
$120 ÷ $6 = 20. *Ans.*

(17.) 36 × $1.25 = $45. Wages.
$45 ÷ $1.50 = 30. *Ans.*

(18.) $3453 ÷ $575.50 = 6. *Ans.*

BILLS AND ACCOUNTS.

PAGE 58.

(3.)

CINCINNATI, O., *Sept. 4, 1877.*

MR. H. KELLY,

Bought of L. M. CHAMBERLIN.

25 yds. Calico	@	12¢,	$3.00	
12 spools Cotton	@	6¢,	.72	
16 yds Alpaca	@	68¢,	10.88	
17 " Muslin	@	15¢,	2.55	
2 bolts Tape	@	10¢,	.20	
			$17.35	*Ans.*

(4.)

NEW PROVIDENCE, PA., *Nov. 5, 1876.*

MR. HIRAM PEOPLES,

Bought of HELM & RAUB.

12	lbs.	Coffee	@	35¢,	$4.20	
23	“	Raisins	@	22¢,	5.06	
15	“	Prunes,	@	16¢,	2.40	
12	“	Crackers	@	15¢,	1.80	
10	“	Rice	@	13¢,	1.30	
41	“	Sugar	@	13¢,	5.33	
					$20.09	*Ans.*

(5.)

WILLIAMSPORT, PA., *Nov. 11, 1876.*

MESSRS. FURST & SONS,

Bought of HERR & ALLISON.

61	bus.	Wheat	@	$1.25,	$76.25	
75	“	“	@	1.21,	90.75	
85	“	“	@	1.27,	107.95	
65	“	Corn	@	65¢,	42.25	
71	“	“	@	72¢,	51.12	
95	“	“	@	68¢,	64.60	
175	“	Oats	@	53¢,	92.75	
140	“	“	@	49¢,	68.60	
					$594.27	*Ans.*

(6.)

NEWARK, N. J., *Oct. 6, 1875.*

MESSRS. RUSSELL & JONES,

To SYKES & BRO., *Dr.*

1875.									
Jan	2.	To	15	yds.	Muslin	@	15¢,	$2.25	
“	“	“	23	“	Calico	@	9¢,	2.07	
“	15.	“	7	“	Cloth	@	$4.25,	29.75	
“	“	“	18	“	Linen	@	53¢,	9.54	
Feb.	7.	“	6	prs.	Boots	@	$5.75,	34.50	
“	“	“	13	doz.	Buttons	@	22¢,	2.86	$80.97

Cr.

1875.				
Jan. 20.	By Cash,		$35.00	
Feb. 1.	" 15 lbs. Butter	@ 33¢,	4.95	
" "	" 5 prs. Chickens	@ 75¢,	3.75	$43.70
			Balance due,	$37.27

(7.)

CARLISLE, PA., *Mar 1, 1876.*

MR. JACOB KAMP,

To CARLISLE SHOE FACTORY, *Dr.*

To	27 prs.	Calfskin Boots	@	$6.75,	$182.25
"	96 "	Gaiters	@	2.37,	227.52
"	126 "	Overshoes	@	.73,	91.98
"	18 "	Slippers	@	1.06,	19.08
"	75 "	Heavy Boots	@	3.81,	285.75
					$806.58

Received Payment,

CARLISLE SHOE FACTORY.

(8.)

PHILADELPHIA, PA., *Apr. 3, 1875.*

MR. JOHN LANE,

To HOOD, BONBRIGHT & CO., *Dr.*

To	95 yds.	Cloth	@	$2.73,	$259.35
"	1600 "	Calico	@	9¢,	144.00
"	1200 "	Muslin	@	13¢,	156.00
"	1200 "	Muslin	@	16¢,	192.00
"	650 "	Cassimere	@	2.17,	1410.50
"	563 "	Merino	@	73¢,	410.99
					$2572.84

Received Payment,

HOOD, BONBRIGHT & CO.

(9.)

(Place and Date.)

(NAME),

To (NAME), *Dr.*

To 27 yds. Calico	@	13¢,	$3.51	
" 45 " Muslin	@	18¢,	8.10	
" 16 " Linen	@	45¢,	7.20	
" 17 " Cambric	@	15¢,	2.55	
" 9 Handkerchiefs	@	45¢,	4.05	$25.41

Cr.

By 12 bus. Potatoes	@	65¢,	$7.80	
" 3 bbls. Apples	@	$3.25,	9.75	
" 13 lbs. Butter	@	35¢,	4.55	$22.10
				$3.31

Received Payment,

(Signature.)

CANCELLATION.

PAGE 64.

(18.) $\dfrac{\overset{13}{\cancel{65}} \times \cancel{15}}{\underset{\cancel{5}}{\cancel{75}}} = 13.$ *Ans.*

(19.) $\dfrac{\overset{3}{\cancel{12}} \times \overset{13}{\overset{\cancel{26}}{\cancel{130}}} \times \cancel{1.25}}{\underset{\cancel{2}}{\cancel{8}} \times \underset{\cancel{5}}{\cancel{6.25}}} = 39.$ *Ans.*

(20.) $\dfrac{\cancel{25} \times \overset{20}{\cancel{1.20}}}{\underset{\cancel{6}}{\cancel{1.50}}} = 20.$ *Ans.*

(21.) $$\frac{\overset{4}{\cancel{12}} \times 22 \times \overset{25}{\cancel{2.25}}}{\underset{\cancel{9}}{\cancel{27}}} = 22.00. \quad \textit{Ans.}$$

GREATEST COMMON DIVISOR.

PAGE 66.

(2.) $15 = 3 \times 5$

$45 = 3 \times 5 \times 3$

$75 = 3 \times 5 \times 5$

Hence, $3 \times 5 = 15 =$ G. C. D.

(5.) $84 = 2 \times 3 \times 7 \times 2$

$126 = 2 \times 3 \times 7 \times 3$

$210 = 2 \times 3 \times 7 \times 5$

Hence, $2 \times 3 \times 7 = 42 =$ G. C. D.

(10.)
$$\begin{array}{r}3\underline{)270,\ 135,\ 162}\\ 3\underline{)90,\ \ 45,\ \ 54}\\ 3\underline{)30,\ \ 15,\ \ 18}\\ 10,\ \ \ 5,\ \ \ 6\end{array}$$

Hence, $3 \times 3 \times 3 = 27 =$ G. C. D.

(11.)
$$\begin{array}{r}2\underline{)108,\ 270,\ 432}\\ 3\underline{)54,\ 135,\ 216}\\ 3\underline{)18,\ \ 45,\ \ 72}\\ 3\underline{)6,\ \ 15,\ \ 24}\\ 2,\ \ \ 5,\ \ \ 8\end{array}$$

Hence, $2 \times 3 \times 3 \times 3 = 54 =$ G. C. D.

(14.)
$$\begin{array}{r}5\underline{)75,\ 300,\ 450}\\ 5\underline{)15,\ \ 60,\ \ 90}\\ 3\underline{)3,\ \ 12,\ \ 18}\\ 1,\ \ \ 4,\ \ \ 6\end{array}$$

Hence, $5 \times 5 \times 3 = 75 =$ G. C. D.

(15.) 2)360, 288, 720, 648
2)180, 144, 360, 324
2)90, 72, 180, 162
3)45, 36, 90, 81
3)15, 12, 30, 27
5, 4, 10, 9

Hence, $2 \times 2 \times 2 \times 3 \times 3 = 72 =$ G. C. D.

PAGE 67.

(3.) 16)20(1
16
4)16(4
16
4)24(6
24

Hence, $4 =$ G. C. D.

(4.) 66)77(1
66
11)66(6
66
11)264(24
22
44
44

PAGE 68.

(11.) 3)24, 18, 42
2)8, 6, 14
4, 3, 7

$3 \times 2 = 6 =$ *Ans.*

(12.) 5)600, 720, 900
2)120, 144, 180
2)60, 72, 90
3)30, 36, 45
10, 12, 15

$5 \times 2 \times 2 \times 3 = 60.$ *Ans.*

(13.) 7)420, 350, 490, 560
5)60, 50, 70, 80
2)12, 10, 14, 16
6, 5, 7, 8

$7 \times 5 \times 2 = 70 =$ G. C. D.

$420 + 350 + 490 + 560 = 1820;$

$1820 \div 70 = 26.$ *Ans.*

(14.)

$$\begin{array}{r@{)}l} 5 & \underline{450,\ 540,\ 420,\ 495} \\ 3 & \underline{90,\ 108,\ 84,\ 99} \\ & 30,\ 36,\ 28,\ 33 \end{array}$$

G. C. D. = 5 × 3 = 15. Length of panel.
450 + 540 + 420 + 495 = 1905. Length around the field.
1905 ÷ 15 = 127. Number of panels.
127 × 5 = 635. Number of rails.

LEAST COMMON MULTIPLE.

PAGE 70.

(7.)

$$\begin{array}{r@{)}l} 3 & \underline{18,\ 21,\ 24,\ 27,\ 30} \\ 3 & \underline{6,\ 7,\ 8,\ 9,\ 10} \\ 2 & \underline{2,\ 7,\ 8,\ 3,\ 10} \\ & 1,\ 7,\ 4,\ 3,\ 5 \end{array}$$

Hence, 3 × 3 × 2 × 7 × 4 × 3 × 5 = 7560 = L. C. M.

(9.)

$$\begin{array}{r@{)}l} 5 & \underline{25,\ 75,\ 100,\ 150} \\ 5 & \underline{5,\ 15,\ 20,\ 30} \\ 3 & \underline{1,\ 3,\ 4,\ 6} \\ 2 & \underline{1,\ 1,\ 4,\ 2} \\ & 1,\ 1,\ 2,\ 1 \end{array}$$

Hence, 5 × 5 × 3 × 2 × 2 = 300 = L. C. M.

(10.)

$$\begin{array}{r@{)}l} 2 & \underline{2,\ 3,\ 4,\ 5,\ 6,\ 7,\ 8,\ 9} \\ 2 & \underline{1,\ 3,\ 2,\ 5,\ 3,\ 7,\ 4,\ 9} \\ 3 & \underline{1,\ 3,\ 1,\ 5,\ 3,\ 7,\ 2,\ 9} \\ & 1,\ 1,\ 1,\ 5,\ 1,\ 7,\ 2,\ 3 \end{array}$$

Hence, 2 × 2 × 3 × 5 × 7 × 2 × 3 = 2520 = L. C. M.

(13.) 5)240, 270, 180, 150
2)48, 54, 36, 30
3)24, 27, 18, 15
3)8, 9, 6, 5
2)8, 3, 2, 5
4, 3, 1, 5

Hence, 5 × 2 × 3 × 3 × 2 × 4 × 3 × 5 = 10800 = L. C. M.

(14.) 3)12, 15, 18
2) 4, 5, 6
2, 5, 3

2 × 2 × 3 × 5 × 3 = 180 = L. C. M.

(15.) 2)8, 12, 30
2)4, 6, 15
3)2, 3, 15
2, 1, 5

2 × 2 × 3 × 2 × 5 = 120 = L. C. M.

(16.) 2)12, 14, 16, 18, 20
2) 6, 7, 8, 9, 10
3) 3, 7, 4, 9, 5
1, 7, 4, 3, 5

2 × 2 × 3 × 7 × 4 × 3 × 5 = 5040 = L. C. M.

(17.) 2)20, 22, 15, 18
3)10, 11, 15, 9
5)10, 11, 5, 3
2, 11, 1, 3

2 × 3 × 5 × 2 × 11 × 3 = 1980 = L. C. M.

1980 min. = 33 hrs.
1980 ÷ 20 = 99 = A's No.
1980 ÷ 22 = 90 = B's "
1980 ÷ 15 = 132 = C's "
1980 ÷ 18 = 110 = D's "

REDUCTION OF FRACTIONS.

PAGE 73.

Oral Solution for Reduction of Mixed Numbers.

(7.) *Ex.* How many 5ths in $9\frac{4}{5}$?

In 1 there are 5 fifths, and in $9\frac{4}{5}$ there are 9 times 5 fifths, or 45 fifths, plus 4 fifths, which are 49 fifths.

PAGE 74.

(9.)

$$\begin{array}{r} 12\frac{2}{23} \\ \underline{23} \\ 36 \\ 24 \\ \underline{2} \\ 278, \text{ or } \frac{278}{23}. \end{array}$$

(10.)

$$\begin{array}{r} 9\frac{12}{15} \\ \underline{15} \\ 135 \\ \underline{12} \\ 147, \text{ or } \frac{147}{15}. \end{array}$$

(11.)

$$\begin{array}{r} 34\frac{9}{11} \\ \underline{11} \\ 374 \\ \underline{9} \\ 383, \text{ or } \frac{383}{11}. \end{array}$$

(12.)

$$\begin{array}{r} 83\frac{12}{15} \\ \underline{15} \\ 415 \\ 83 \\ \underline{12} \\ 1257, \text{ or } \frac{1257}{15}. \end{array}$$

(13.)

$$\begin{array}{r} 51\frac{50}{51} \\ \underline{51} \\ 51 \\ 255 \\ \underline{50} \\ 2651, \text{ or } \frac{2651}{51}. \end{array}$$

(14.)

$$\begin{array}{r} 173\frac{9}{10} \\ \underline{10} \\ 1730 \\ \underline{9} \\ 1739, \text{ or } \frac{1739}{10}. \end{array}$$

Oral Solution for the Reduction of an Improper Fraction to a Whole or a Mixed Number.

Ex. Reduce $\frac{14}{3}$ to a mixed number.

Since 1 equals $\frac{3}{3}$, in $\frac{14}{3}$ there are as many *ones* as $\frac{3}{3}$ is contained in $\frac{14}{3}$, or $4\frac{2}{3}$.

PAGE 75.

(8.) $\frac{548}{22} = 548 \div 22 = 24\frac{20}{22}$.

(9.) $\frac{183}{55} = 183 \div 55 = 3\frac{18}{55}$.

(10.) $\frac{879}{145} = 879 \div 145 = 6\frac{9}{145}$.

(11.) $\frac{616}{96} = 616 \div 96 = 6\frac{40}{96}$.

(12.) $\frac{5184}{350} = 5184 \div 350 = 14\frac{284}{350}$.

(13.) $\frac{6912}{221} = 6912 \div 221 = 31\frac{61}{221}$.

PAGE 77.

(8.) $\frac{81}{189} \div \frac{3\times 9}{3\times 9} = \frac{3}{7}$.

(9). $\frac{360}{576} \div \frac{4\times 3\times 6}{4\times 3\times 6} = \frac{5}{8}$.

(13.) $\frac{567}{783} \div \frac{3\times 3\times 3}{3\times 3\times 3} = \frac{21}{29}$.

Second Solution.

$\frac{81}{189} \div \frac{3}{3} = \frac{27}{63}$

$\frac{27}{63} \div \frac{9}{9} = \frac{3}{7}$

Second Solution.

$\frac{360}{576} \div \frac{4}{4} = \frac{90}{144}$

$\frac{90}{144} \div \frac{3}{3} = \frac{30}{48}$

$\frac{30}{48} \div \frac{6}{6} = \frac{5}{8}$

Second Solution.

$\frac{567}{783} \div \frac{3}{3} = \frac{189}{261}$

$\frac{189}{261} \div \frac{3}{3} = \frac{63}{87}$

$\frac{63}{87} \div \frac{3}{3} = \frac{21}{29}$

NOTE.—The remaining problems in this case may be solved in a similar manner.

PAGE 78.—*Oral Exercises.*

9. If I had $\frac{1}{2}$ a ton of coal, and gave my neighbor $\frac{1}{5}$ of it, I gave him $\frac{1}{5}$ of $\frac{1}{2}$ a ton, or $\frac{1}{10}$ of a ton; if he gave to his brother $\frac{1}{3}$ of his share, he gave to his brother $\frac{1}{3}$ of $\frac{1}{10}$ of a ton, or $\frac{1}{30}$ of a ton. Hence, his brother received $\frac{1}{30}$ of a ton.

22. If I had $\frac{3}{4}$ of a bushel, and gave away $\frac{5}{6}$ of what I had, I gave away $\frac{5}{6}$ of $\frac{3}{4}$ of a bushel, or $\frac{15}{24}$ of a bushel, and had remaining the difference between $\frac{18}{24}$ and $\frac{15}{24}$, or $\frac{3}{24}$, of a bushel, which is equal to $\frac{1}{8}$ of a bushel.

23. If a boy had $\frac{9}{10}$ of a dollar, and spent $\frac{3}{5}$ of it, he spent $\frac{3}{5}$ of $\frac{9}{10}$ of a dollar, or $\frac{27}{50}$ of a dollar, and had remaining $\frac{45}{50} - \frac{27}{50}$, or $\frac{18}{50}$ of a dollar.

24. If $\frac{1}{5}$ of a barrel leaked away, there remained $\frac{4}{5}$ of a barrel. He sold $\frac{2}{3}$ of $\frac{4}{5}$ of a barrel, or $\frac{8}{15}$ of a barrel, and had remaining $\frac{4}{5}-\frac{8}{15}$, or $\frac{4}{15}$, of a barrel.

PAGE 79.

(9.) $\frac{15}{79}\times\frac{\cancel{18}}{\cancel{23}}\times\frac{\overset{3}{\cancel{69}}}{\underset{2}{\cancel{36}}}=\frac{45}{158}$. (10.) $\frac{2}{\cancel{5}}\times\frac{\cancel{6}}{7}\times\frac{8}{9}\times\frac{\overset{2}{\cancel{10}}}{\underset{\cancel{2}}{\cancel{12}}}=\frac{16}{63}$.

(11.) $\frac{2}{5}\times\frac{11}{12}\times\frac{13}{4}\times\frac{6}{8}=\frac{143}{160}$. (12.) $\frac{3}{4}\times\frac{6}{7}\times\frac{8}{9}\times\frac{14}{15}=\frac{8}{15}$.

(13.) $\frac{18}{25}\times\frac{12}{15}\times\frac{99}{88}\times\frac{22}{90}\times\frac{180}{270}=\frac{66}{625}$. (14.) $\frac{3}{4}\times\frac{7}{9}=\frac{7}{12}$.

(15.) $\frac{9}{10}\times\frac{1}{16}=\frac{9}{160}$. (16.) $\frac{2}{3}\times\frac{1}{13}=\frac{2}{39}$.

(17.) $\frac{2}{3}\times\frac{6}{7}\times\frac{9}{12}\times\frac{14}{20}\times300=90$.

(18.) $\frac{8}{15}\times\frac{11}{33}\times\frac{48}{55}\times\frac{19}{16}\times6000=960$.

PAGE 80.

(8, *Oral.*) The common denominator of $\frac{2}{3}$ and $\frac{4}{5}$ is 15; $\frac{1}{3}=\frac{5}{15}$, and $\frac{2}{3}=\frac{10}{15}$; $\frac{1}{5}=\frac{3}{15}$, and $\frac{4}{5}=\frac{12}{15}$.

REMARK. Solve the 9th, 10th and 11th in the same manner.

(12, *Oral.*) $1\frac{1}{2}=\frac{3}{2}$; $2\frac{3}{4}=\frac{11}{4}$, and $3\frac{1}{5}=\frac{16}{5}$. The common denominator of the fractions is 20. $\frac{1}{2}=\frac{10}{20}$, and $\frac{3}{2}=\frac{30}{20}$; $\frac{1}{4}=\frac{5}{20}$, and $\frac{11}{4}=\frac{55}{20}$; $\frac{1}{5}=\frac{4}{20}$, and $\frac{16}{5}=\frac{64}{20}$.

PAGE 82.

(7.) $\frac{7}{8}$, $\frac{2}{10}$, $\frac{9}{16}$, and $9\frac{5}{6}$, or $\frac{59}{6}$.

$$\begin{array}{r|l} 2 & 8,\ 10,\ 16,\ 6 \\ \hline 2 & 4,\ \ 5,\ \ 8,\ 3 \\ \hline 2 & 2,\ \ 5,\ \ 4,\ 3 \\ \hline & 1,\ \ 5,\ \ 2,\ 3 \end{array}$$

$$\begin{aligned} \tfrac{7}{8}\times\tfrac{30}{30}&=\tfrac{210}{240} \\ \tfrac{2}{10}\times\tfrac{24}{24}&=\tfrac{48}{240} \\ \tfrac{9}{16}\times\tfrac{15}{15}&=\tfrac{135}{240} \\ \tfrac{59}{6}\times\tfrac{40}{40}&=\tfrac{2360}{240}. \end{aligned}$$

L. C. D. $=2\times2\times2\times5\times2\times3=240$.

(8.) $\frac{11}{14}$, $\frac{3}{22}$, $\frac{9}{33}$, and $5\frac{4}{9}$, or $\frac{49}{9}$.

11)14, 22, 33, 9
2)14, 2, 3, 9
3) 7, 1, 3, 9
7, 1, 1, 3

$\frac{11}{14} \times \frac{99}{99} = \frac{1089}{1386}$
$\frac{3}{22} \times \frac{63}{63} = \frac{189}{1386}$
$\frac{9}{33} \times \frac{42}{42} = \frac{378}{1386}$
$\frac{49}{9} \times \frac{154}{154} = \frac{7546}{1386}$.

L. C. D. = 11 × 2 × 3 × 7 × 3 = 1386.

(9.) $\frac{7}{12}$, $\frac{5}{6}$ of $\frac{15}{18}$, $\frac{1}{6}$ of $\frac{9}{15}$.

$\frac{5}{6}$ of $\frac{15}{18} = \frac{25}{36}$
$\frac{1}{6}$ of $\frac{9}{15} = \frac{1}{10}$
3)12, 36, 10
2)4, 12, 10
2)2, 6, 5
1, 3, 5

$\frac{7}{12} \times \frac{15}{15} = \frac{105}{180}$
$\frac{25}{36} \times \frac{5}{5} = \frac{125}{180}$
$\frac{1}{10} \times \frac{18}{18} = \frac{18}{180}$.

L. C. D. = 3 × 2 × 2 × 3 × 5 = 180.

(10.) $\frac{16}{21}$, $\frac{2}{3}$ of $\frac{21}{16}$, $\frac{1}{2}$ of $\frac{1}{3}$ of $4\frac{2}{7}$.

$\frac{2}{3}$ of $\frac{21}{16} = \frac{7}{8}$
$\frac{1}{2}$ of $\frac{1}{3}$ of $4\frac{2}{7} = \frac{5}{7}$.
7)21, 8, 7
3, 8, 1

$\frac{16}{21} \times \frac{8}{8} = \frac{128}{168}$
$\frac{7}{8} \times \frac{21}{21} = \frac{147}{168}$
$\frac{5}{7} \times \frac{24}{24} = \frac{120}{168}$.

L. C. D. = 7 × 3 × 8 = 168.

ADDITION OF FRACTIONS.

PAGE 82.—*Oral Exercise.*

9. The common denominator is 15, $\frac{1}{3} = \frac{5}{15}$, and $\frac{2}{3} = \frac{10}{15}$; $\frac{1}{5} = \frac{3}{15}$, and $\frac{4}{5} = \frac{12}{15}$; $\frac{10}{15}$ and $\frac{12}{15}$ are $\frac{22}{15}$, or $1\frac{7}{15}$.

15. $2\frac{1}{2} = \frac{5}{2}$, $3\frac{1}{3} = \frac{10}{3}$. The common denominator of the two fractions is 6. $\frac{1}{2} = \frac{3}{6}$, and $\frac{5}{2} = \frac{15}{6}$; $\frac{1}{3} = \frac{2}{6}$, and $\frac{10}{3} = \frac{20}{6}$; $\frac{15}{6}$ plus $\frac{20}{6} = \frac{35}{6}$, or $5\frac{5}{6}$.

21. $2\frac{1}{2} = \frac{5}{2}$, $3\frac{1}{4} = \frac{13}{4}$, and $5\frac{1}{8} = \frac{41}{8}$. The common denomi-

nator of the fractions is 8. $\frac{1}{2}=\frac{4}{8}$, and $\frac{5}{2}=\frac{20}{8}$; $\frac{1}{4}=\frac{2}{8}$, and $\frac{13}{4}=\frac{26}{8}$; $\frac{20}{8}$ plus $\frac{26}{8}$ plus $\frac{41}{8}$, are $\frac{87}{8}$, or $10\frac{7}{8}$.

Sol. 2. $2+3+5=10$; $\frac{1}{2}+\frac{1}{4}+\frac{1}{8}=\frac{7}{8}$; hence $2\frac{1}{2}+3\frac{1}{4}+5\frac{1}{8}=10\frac{7}{8}$.

32. $\frac{5}{9}+\frac{3}{4}=\frac{20}{36}+\frac{27}{36}=\frac{47}{36}$. If $\frac{47}{36}$ of a bushel equals 235 apples, $\frac{1}{36}$ of a bushel equals $\frac{1}{47}$ of 235 apples, or 5 apples, and $\frac{36}{36}$, or a bushel, equals 36 times 5 apples, or 180 apples.

33. $\frac{2}{3}+\frac{1}{7}=\frac{14}{21}+\frac{3}{21}$, or $\frac{17}{21}$. If $\frac{17}{21}$ of my money equals \$136, $\frac{1}{21}$ equals $\frac{1}{17}$ of \$136, or \$8, and $\frac{21}{21}$ equals 21 times \$8, or \$168.

Page 84.

(15.)
$$\begin{array}{rr}
12\frac{3}{5} & \frac{3}{5}=\frac{18}{30} \\
28\frac{5}{6} & \frac{5}{6}=\frac{25}{30} \\
\underline{15\frac{2}{3}} & \frac{2}{3}=\underline{\frac{20}{30}} \\
55 & \frac{63}{30}=2\frac{1}{10}. \\
\underline{2\frac{1}{10}} & \\
57\frac{1}{10}. &
\end{array}$$

(16.)
$$\begin{array}{rr}
45\frac{2}{9} & \frac{2}{9}=\frac{8}{36} \\
56\frac{3}{4} & \frac{3}{4}=\frac{27}{36} \\
\underline{38\frac{1}{6}} & \frac{1}{6}=\underline{\frac{6}{36}} \\
139 & \frac{41}{36}=1\frac{5}{36}. \\
\underline{1\frac{5}{36}} & \\
140\frac{5}{36}. &
\end{array}$$

(17.)
$$\begin{array}{r}
\frac{1}{3}\text{ of }\frac{1}{4}=\frac{1}{12}=\frac{5}{60} \\
\frac{1}{2}\text{ of }\frac{1}{5}=\frac{1}{10}=\frac{6}{60} \\
9\frac{1}{4}=\frac{37}{4}=\underline{\frac{555}{60}} \\
\frac{566}{60}=9\frac{13}{30}.
\end{array}$$

(18.)
$$\begin{array}{r}
\frac{2}{3}\text{ of }\frac{4}{5}=\frac{8}{15}=\frac{32}{60} \\
\frac{1}{2}\text{ of }6\frac{1}{2}=3\frac{1}{4}=3\frac{15}{60} \\
10\frac{5}{6}=\underline{10\frac{50}{60}} \\
13\frac{97}{60}=14\frac{37}{60}.
\end{array}$$

(19.)
$$\begin{array}{rl}
28\frac{1}{4} & \frac{4}{3}\text{ of }19\frac{1}{2}=26 \\
39\frac{2}{3} & \\
\underline{26} & \\
93\frac{11}{12}. &
\end{array}$$

(20.)
$$\begin{array}{r}
16\frac{4}{5}=16\frac{48}{60} \\
19\frac{1}{4}=19\frac{15}{60} \\
21\frac{2}{3}=\underline{21\frac{40}{60}} \\
56\frac{103}{60}=57\frac{43}{60}.
\end{array}$$

(21.)
$$\begin{array}{r}
1\frac{1}{10}=1\frac{4}{40} \\
6\frac{2}{5}=6\frac{16}{40} \\
18\frac{19}{20}=18\frac{38}{40} \\
2\frac{6}{40}=\underline{2\frac{6}{40}} \\
27\frac{64}{40}=28\frac{3}{5}.
\end{array}$$

(22.)
$$\begin{array}{rr}
3\frac{3}{4}=3\frac{6}{8} & \$17\frac{1}{8}=\$17\frac{5}{40} \\
5\frac{1}{2}=5\frac{4}{8} & 23\frac{1}{4}=23\frac{10}{40} \\
8\frac{1}{8}=\underline{8\frac{1}{8}} & 27\frac{1}{5}=\underline{27\frac{8}{40}} \\
17\frac{3}{8}. & \$67\frac{23}{40}.
\end{array}$$

SUBTRACTION OF FRACTIONS.

PAGE 86.—*Oral Exercise.*

36. If I sell to one person $22\frac{1}{4}$ yards and to another $27\frac{7}{8}$ yards, to both I sell $22\frac{1}{4}$ yards plus $27\frac{7}{8}$ yards, or $50\frac{1}{8}$ yards. I therefore have remaining the difference between $65\frac{1}{2}$ yards and $50\frac{1}{8}$ yards, or $15\frac{3}{8}$ yards.

37. If he sold $\frac{1}{3}$ to one man and $\frac{3}{6}$ to another, he sold $\frac{1}{3}$ and $\frac{3}{6}$, or $\frac{5}{6}$, of his corn. He then had $\frac{1}{6}$ of his corn, or 50 bushels, remaining. If 50 bushels is $\frac{1}{6}$ of his corn, $\frac{6}{6}$, or the whole number of bushels, is 6 times 50 bushels, or 300 bushels.

39. If B spent $\frac{2}{3}$ of his fortune, he had $\frac{1}{3}$ remaining. If \$600 was $\frac{3}{7}$ of this remainder, $\frac{1}{7}$ was $\frac{1}{3}$ of \$600, or \$200, and $\frac{7}{7}$ was 7 times \$200, or \$1400. If \$1400 was $\frac{1}{3}$ of his money, $\frac{3}{3}$, or the whole amount, was 3 times \$1400, or \$4200.

40. If C lost $\frac{3}{4}$ of $\frac{5}{7}$ of his money, he lost $\frac{15}{28}$, and had remaining $\frac{28}{28}-\frac{15}{28}$, or $\frac{13}{28}$, and \$260 was $\frac{2}{5}$ of this remainder. $\frac{1}{5}$ of the remainder was $\frac{1}{2}$ of \$260, or \$130, and $\frac{5}{5}$, or the remainder, was 5 times \$130, or \$650. If \$650 was $\frac{13}{28}$ of his money, $\frac{1}{28}$ was $\frac{1}{13}$ of \$650, or \$50, and $\frac{28}{28}$, or his money, was 28 times \$50, or \$1400.

PAGE 87.—*Written Problems.*

(20.) $21\frac{3}{4}=21\frac{15}{20}$

$19\frac{1}{2}=19\frac{10}{20}$

$24\frac{3}{5}=\underline{24\frac{12}{20}}$

$64\frac{37}{20}=65\frac{17}{20}$. Amt. sold.

$95\frac{1}{5}-65\frac{17}{20}=95\frac{4}{20}-65\frac{17}{20}=29\frac{7}{20}$.

(21.) $125\frac{1}{4}+125\frac{1}{4}=250\frac{1}{2}$. No. of yards.

$26\frac{7}{8}+47\frac{1}{2}=74\frac{3}{8}$. No. yards sold.

$250\frac{1}{2}-74\frac{3}{8}=176\frac{1}{8}$. *Ans.*

(22.) $18\frac{3}{4}$
$62\frac{1}{2}$
$31\frac{1}{4}$
$112\frac{1}{2}$. Cost of all.
$200 - 112\frac{1}{2} = 87\frac{1}{2}$. *Ans.*

(23.) $\$107\frac{4}{5}$
$215\frac{3}{10}$
$317\frac{1}{2}$
$245\frac{3}{4}$
$\$886\frac{7}{20}$ = Amt. paid.
$\$1000 - \$886\frac{7}{20} = \$113\frac{13}{20}$. Amt. due.

(24.) $\frac{3}{4} \times \frac{1}{2} \times \$1000 = \$375.$ Amt. I had.
$\frac{5}{6} \times \frac{3}{7} \times 630 = 225.$ Amt. lost.
$150 remaining.

MULTIPLICATION OF FRACTIONS.

PAGE 89.—*Written Problems.*

(10.) $63\frac{4}{7} \times 56 = \frac{445}{7} \times 56 = 3560.$

(11.) $45\frac{13}{18} \times 60 = \frac{823}{18} \times 60 = \frac{8230}{3} = 2743\frac{1}{3}.$

PAGE 90.—*Oral Exercise.*

9. $\frac{3}{5}$ of A's fortune is $\frac{3}{5}$ of $3200, or $1920. If $1920 is 6 times B's fortune, once B's is $\frac{1}{6}$ of $1920, which is $320.

12. $\frac{1}{6}$ of 24 yards is 4 yards, and $\frac{5}{6}$ of 24 yards is 5 times 4 yards, or 20 yards. If 20 yards cost $3.20, 1 yard costs $\frac{1}{20}$ of $3.20, or 16 cents, and for $1.44 as many yards can be bought as 16 is contained times in 144, or 9 yards.

14. $\frac{2}{9}$ of $81 is $18; $18 plus $40 equals $58. If $58 is $\frac{1}{4}$ of the cost of the lot, the whole cost is 4 times $58, or $232.

15. If a farmer sold at one time $\frac{3}{10}$ of his wheat, and at another $\frac{1}{4}$, he sold $\frac{3}{10}$ plus $\frac{1}{4}$, or $\frac{11}{20}$, and had remaining $\frac{9}{20}$. $\frac{9}{20}$ of 600 bushels is 270 bushels.

16. $\frac{3}{9}$ of 81 is 27; $\frac{1}{2}$ of 18 is 9; 27 is 3 times 9.

PAGE 91.

30. If 12 feet lacks 4 feet of being $\frac{4}{11}$, 12 feet plus 4 feet, or 16 feet, equals $\frac{4}{11}$ of the length of the other part; $\frac{1}{11}$ is $\frac{1}{4}$ of 16 feet, or 4 feet, and $\frac{11}{11}$ is 11 times 4 feet, or 44 feet. The length of the pole is therefore 44 feet and 12 feet, or 56 feet.

32. $6\frac{1}{4}$ times 16 dollars is 100 dollars. If 100 dollars is 5 times Emma's number, her number is $\frac{1}{5}$ of 100 dollars, which is 20 dollars.

PAGE 92.—*Written Problems.*

(16.)	$\$325$	$\$325$	$\$325$, A's.
	$6\frac{4}{5}$	$18\frac{3}{4}$	2210, B's.
	1950	2600	$6093\frac{3}{4}$, C's.
	260	325	$\$8628\frac{3}{4}$. All.
	$\$2210$ = B's.	$243\frac{3}{4}$	
		$\$6093\frac{3}{4}$ = C's.	

PAGE 92.—*Oral Exercise.*

7. $\$28\frac{1}{2}$ equals $\$\frac{57}{2}$. If 12 pairs cost $\$\frac{57}{2}$, 1 pair costs $\frac{1}{12}$ of $\$\frac{57}{2}$, or $\$\frac{57}{24}$, and 5 pairs cost 5 times $\$\frac{57}{24}$, or $\$\frac{285}{24}$, which is equal to $\$11\frac{7}{8}$.

8. $2\frac{3}{4}$ pounds equal $\frac{11}{4}$ pounds; $8\frac{1}{2}$ cents equal $\frac{17}{2}$ cents. $\frac{1}{4}$ of a pound will cost $\frac{1}{4}$ of $\frac{17}{2}$ cents, or $\frac{17}{8}$ cents, and $\frac{11}{4}$ pounds will cost 11 times $\frac{17}{8}$ cents, or $\frac{187}{8}$ cents, which is equal to $23\frac{3}{8}$ cents.

PAGE 93.—*Written Problems.*

(10.) $\frac{11}{12} \times \frac{3}{22} \times 21\frac{2}{7} = \frac{11}{12} \times \frac{3}{22} \times \frac{149}{7} = \frac{149}{56} = 2\frac{37}{56}$.

(11.) $9\frac{5}{7} \times 35\frac{7}{8} = \frac{68}{7} \times \frac{287}{8} = \frac{697}{2} = 348\frac{1}{2}$.

(13.) $\frac{1}{4}$ of $3\frac{4}{7} \times \frac{2}{9}$ of $5\frac{1}{5} = \frac{1}{4} \times \frac{25}{7} \times \frac{2}{9} \times \frac{26}{5} = \frac{65}{63} = 1\frac{2}{63}$.

(14.) A $= \frac{3}{4}$ of \$375 $=$ \$$281\frac{1}{4} =$ \$$\frac{1125}{4}$.

B $= \frac{4}{5} \times$ \$$\frac{1125}{4} =$ \$225.

\$$281\frac{1}{4}$ + \$225 $=$ \$$506\frac{1}{4} =$ \$$\frac{2025}{4} =$ both.

C $= \frac{3}{5} \times$ \$$\frac{2025}{4} =$ \$$\frac{1215}{4} =$ \$$303\frac{3}{4}$.

All $=$ \$$281\frac{1}{4}$ + \$225 + \$$303\frac{3}{4} =$ \$810.

DIVISION OF FRACTIONS.

PAGE 94.—*Oral Exercise.*

8. If a man shares $\frac{8}{9}$ of a ton *among* 5 neighbors, each receives $\frac{1}{5}$ of $\frac{8}{9}$ of a ton, or $\frac{8}{45}$ of a ton.

9. If I share \$$4\frac{4}{5}$ equally *with* 3 companions, there are 4 shares; hence, each receives $\frac{1}{4}$ of \$$4\frac{4}{5}$, or \$$1\frac{1}{5}$.

12. 1 is contained in $\frac{3}{4}$, $\frac{3}{4}$ of a time, and 7 is contained $\frac{1}{7}$ of $\frac{3}{4}$, or $\frac{3}{28}$, of a time.

PAGE 95.—*Written Problems.*

(10.) $63\frac{4}{7} \div 11 = \frac{1}{11}$ of $\frac{445}{7} = \frac{445}{77}$, or $5\frac{60}{77}$.

(11.) $117\frac{1}{5} \div 8 = \frac{1}{8}$ of $\frac{586}{5} = \frac{586}{40}$, or $14\frac{13}{20}$.

(12.) $233\frac{1}{3} \div 14 = \frac{1}{14}$ of $\frac{700}{3} = \frac{50}{3}$, or $16\frac{2}{3}$.

PAGE 96.

(7.) $125 \div 3\frac{4}{7} = 125 \div \frac{25}{7} = 125 \times \frac{7}{25} = 35$.

(8.) $118 \div 5\frac{1}{6} = 118 \div \frac{31}{6} = 118 \times \frac{6}{31} = 22\frac{26}{31}$.

(9.) $745 \div 21\frac{2}{7} = 745 \div \frac{149}{7}$, or $745 \times \frac{7}{149} = 35$.

PAGE 97.—*Oral Exercise.*

7. If 3 bushels cost \$$3\frac{3}{4}$, 1 bushel costs $\frac{1}{3}$ of \$$3\frac{3}{4}$, or \$$1\frac{1}{4}$, and for \$15 I can buy as many bushels as $1\frac{1}{4}$, or $\frac{5}{4}$, is contained times in 15, or 12 bushels.

8. If 4 hats cost \$$5\frac{1}{2}$, or \$$\frac{11}{2}$, 1 hat will cost $\frac{1}{4}$ of \$$\frac{11}{2}$, which is \$$\frac{11}{8}$, and for \$$8\frac{1}{4}$, or \$$\frac{33}{4}$, I can buy as many hats as $\frac{11}{8}$ is contained times in $\frac{33}{4}$, or 6 hats.

9. If $5\frac{1}{3}$, or $\frac{16}{3}$, apples cost $11\frac{1}{3}$, or $\frac{34}{3}$, cents, 1 apple costs as many cents as $\frac{16}{3}$ is contained times in $\frac{34}{3}$, which is $\frac{34}{16}$, and 8 apples will cost 8 times $\frac{34}{16}$ cents, or 17 cents.

10. 1 is contained in $\frac{3}{4}$, $\frac{3}{4}$ of a time, and $\frac{1}{3}$ is contained in $\frac{3}{4}$ 3 times $\frac{3}{4}$ times, or $\frac{9}{4}$ times, and $\frac{2}{3}$ is contained $\frac{1}{2}$ of $\frac{9}{4}$ times, or $\frac{9}{8}$ times.

Page 98.—*Written Problems.*

(11.) $38\frac{1}{6} \div \frac{8}{14} = \frac{229}{6} \div \frac{8}{14} = \frac{229}{6} \times \frac{14}{8} = \frac{1603}{24}$, or $66\frac{19}{24}$.

(12.) $\frac{3}{8}$ of $20 \div 9\frac{3}{4} = \frac{3}{8} \times 20 \div \frac{39}{4} = \frac{3}{8} \times 20 \times \frac{4}{39} = \frac{10}{13}$.

(13.) $48\frac{4}{5} \div 17\frac{1}{3} = \frac{244}{5} \div \frac{52}{3} = \frac{244}{5} \times \frac{3}{52} = \frac{183}{65}$, or $2\frac{53}{65}$.

(14.) $\frac{3}{7}$ of $24\frac{1}{7} \div \frac{11}{7} = \frac{3}{7} \times \frac{169}{7} \times \frac{7}{11} = \frac{507}{77} = 6\frac{45}{77}$.

(15.) $\frac{2}{9}$ of $35\frac{1}{2} \div \frac{5}{7}$ of $8\frac{2}{5} = \frac{2}{9} \times \frac{71}{2} \times \frac{7}{5} \times \frac{5}{42} = \frac{71}{54}$, or $1\frac{17}{54}$.

COMPLEX FRACTIONS.

(2.) $\frac{15}{18} \div \frac{6}{7} = \frac{15}{18} \times \frac{7}{6} = \frac{35}{36}$.

(4.) $\frac{8}{21} \div 24 = \frac{1}{24} \times \frac{8}{21} = \frac{1}{63}$.

(5.) $84 \div \frac{7}{12} = 84 \times \frac{12}{7} = 144$.

(6.) $7\frac{1}{3} \div 4\frac{2}{7} = \frac{22}{3} \times \frac{7}{30} = \frac{77}{45}$, or $1\frac{32}{45}$.

(7.) $21\frac{2}{7} \div 14 = \frac{149}{7} \times \frac{1}{14} = \frac{149}{98}$, or $1\frac{51}{98}$.

(8.) $20 \div 6\frac{3}{5} = 20 \times \frac{5}{33} = \frac{100}{33}$, or $3\frac{1}{33}$.

(9.) $6\frac{4}{5} \div \frac{4}{7} = \frac{34}{5} \times \frac{7}{4} = \frac{119}{10}$, or $11\frac{9}{10}$.

(10.) $\frac{7}{9} \div 7\frac{1}{3} = \frac{7}{9} \times \frac{3}{22} = \frac{7}{66}$.

(11.) $\frac{7}{8}$ of $\frac{4}{7} \div \frac{4}{7}$ of $\frac{8}{14} = \frac{7}{8} \times \frac{4}{7} \times \frac{7}{4} \times \frac{14}{8} = \frac{49}{32}$, or $1\frac{17}{32}$.

(12.) $\frac{3}{5}$ of $2\frac{1}{5} \div 1\frac{5}{7} = \frac{3}{5} \times \frac{11}{5} \times \frac{7}{12} = \frac{77}{100}$.

(13.) $(\frac{7}{8}+\frac{4}{7})\div(\frac{5}{7}+\frac{1}{6})=\frac{81}{56}\div\frac{37}{42}=\frac{81}{56}\times\frac{42}{37}=\frac{486}{296}$, or $1\frac{95}{148}$.

(14.) $(\frac{6}{9}-\frac{3}{10})\div(\frac{5}{7}-\frac{2}{3})=\frac{11}{30}\div\frac{1}{21}=\frac{11}{30}\times21=\frac{77}{10}$, or $7\frac{7}{10}$.

(15.) $(\frac{1}{3}\div\frac{1}{6})\times(\frac{9}{16}\div\frac{5}{60})=\frac{1}{3}\times\frac{6}{1}\times\frac{9}{16}\times\frac{60}{5}=\frac{27}{2}=13\frac{1}{2}$.

RELATION OF NUMBERS.

CASE I.—PAGE 100.

(4.) $\frac{5}{5}-\frac{2}{5}=\frac{3}{5}=$ Remainder.
$\frac{1}{5}=\frac{1}{2}$ of $\frac{2}{5}$
$\frac{3}{5}=\frac{3}{2}$ of $\frac{2}{5}$. *Ans.*

(5.) $\frac{3}{5}$ of $100=60$
$60-10=50=$ Sister's money.
$50=\frac{1}{2}$ of 100. *Ans.*

CASE II.—*Written Problems.*

(6.) The relation of $\frac{2}{3}$ of $5\frac{1}{3}$ to 16 is $\frac{2}{3}$ of $\frac{16}{3}\div16=\frac{2}{9}$.

(7.) The relation of $\frac{1}{2}$ of $\frac{3}{4}$ of 5 to 20 is $\frac{1}{2}\times\frac{3}{4}\times5\div20=\frac{3}{32}$.

CASE III.—PAGE 101.—*Written Problems.*

(8.) $84\div\frac{1}{2}$ of $3\frac{3}{4}=84\times\frac{2}{1}\times\frac{4}{15}=\frac{672}{15}$, or $44\frac{4}{5}$.

(9.) $75\div\frac{3}{4}$ of $\frac{5}{6}=75\times\frac{4}{3}\times\frac{6}{5}=120$.

CASE IV—.*Oral.*

10. $8\frac{1}{3}=\frac{25}{3}$; $2\frac{1}{5}=\frac{11}{5}$; $\frac{1}{3}$ is $\frac{1}{25}$ of $\frac{25}{3}$, and $\frac{3}{3}$, or 1, is 3 times $\frac{1}{25}$, or $\frac{3}{25}$, of $\frac{25}{3}$; hence $\frac{11}{5}$ is $\frac{11}{5}$ times $\frac{3}{25}$, or $\frac{33}{125}$ of $\frac{25}{3}$, or $\frac{33}{125}$ of $8\frac{1}{3}$.

PAGE 102.—*Written Problems.*

(5.) $6\frac{1}{2}\div7\frac{1}{2}=\frac{13}{2}\div\frac{15}{2}=\frac{13}{2}\times\frac{2}{15}=\frac{13}{15}$.

(6.) $\frac{3}{4}$ of $\frac{5}{6}\div\frac{8}{9}$ of $\frac{15}{12}=\frac{3}{4}\times\frac{5}{6}\times\frac{9}{8}\times\frac{12}{15}=\frac{9}{16}$.

(7.) $\frac{3}{4}$ of $2\frac{1}{3}\div\frac{5}{6}$ of $2\frac{3}{4}=\frac{3}{4}\times\frac{7}{3}\times\frac{6}{5}\times\frac{4}{11}=\frac{42}{55}$.

GREATEST COMMON DIVISOR OF FRACTIONS.

PAGE 105.

(7.) $6\frac{1}{2}, 3\frac{1}{4}, 2\frac{3}{5} = \frac{13}{2}, \frac{13}{4}, \frac{13}{5}$.
G. C. D. of 13, 13, 13 = 13.
L. C. M. of 2, 4, 5 = 20.
Hence, G. C. D. of $6\frac{1}{2}, 3\frac{1}{4}, 2\frac{3}{5} = \frac{13}{20}$.

(8.) $58\frac{2}{5}, 22\frac{1}{10}, 12\frac{1}{15} = \frac{292}{5}, \frac{221}{10}, \frac{181}{15}$.
G. C. D. of 292, 221, 181 = 1.
L. C. M. of 5, 10, 15 = 30.
Hence, G. C. D. of $58\frac{2}{5}, 22\frac{1}{10}, 12\frac{1}{15} = \frac{1}{30}$.

(9.) $12\frac{1}{2}, 3\frac{1}{3}, 17\frac{1}{7} = \frac{25}{2}, \frac{10}{3}, \frac{120}{7}$.
G. C. D. of 25, 10, 120 = 5.
L. C. M. of 2, 3, 7 = 42.
Hence, G. C. D. of $12\frac{1}{2}, 3\frac{1}{3}, 17\frac{1}{7} = \frac{5}{42}$.

LEAST COMMON MULTIPLE OF FRACTIONS.

PAGE 106.

(6.) $3\frac{1}{3}, 3\frac{5}{7}, 7\frac{1}{3} = \frac{10}{3}, \frac{26}{7}$ $\frac{22}{3}$.
L. C. M. of 10, 26, 22 = 1430.
G. C. D. of 3, 7, 3 = 1.
Hence, L. C. M. of $3\frac{1}{3}, 3\frac{5}{7}, 7\frac{1}{3} = 1430$.

(7.) $6\frac{3}{7}, 3\frac{6}{7}, 2\frac{1}{7} = \frac{45}{7}, \frac{27}{7}, \frac{15}{7}$.
L. C. M. of 45, 27, 15 = 135.
G. C. D. of 7, 7, 7 = 7.
Hence, L. C. M. of $6\frac{3}{7}, 3\frac{6}{7}, 2\frac{1}{7} = \frac{135}{7} = 19\frac{2}{7}$.

(8.) $3\frac{1}{2}, 5\frac{1}{4}, 3\frac{3}{8} = \frac{7}{2}, \frac{21}{4}, \frac{27}{8}$.
L. C. M. of 7, 21, 27 = 189.
G. C. D. of 2, 4, 8 = 2.
Hence, L. C. M. of $3\frac{1}{2}, 5\frac{1}{4}, 3\frac{3}{8} = \frac{189}{2} = 94\frac{1}{2}$.

(9.) $3\frac{1}{4}, 5\frac{1}{6}, 2\frac{1}{7}, 3\frac{1}{8} = \frac{13}{4}, \frac{31}{6}, \frac{15}{7}, \frac{25}{8}$.
L. C. M. of 13, 31, 15, 25 = 30225.
G. C. D. of 4, 6, 7, 8 = 1.
Hence, L. C. M. of $3\frac{1}{4}, 5\frac{1}{6}, 2\frac{1}{7}, 3\frac{1}{8} = 30225$.

(10.) $7\frac{1}{2}, 6\frac{1}{4}, 6\frac{2}{3}, 7\frac{1}{5} = \frac{15}{2}, \frac{25}{4}, \frac{20}{3}, \frac{36}{5}$.
L. C. M. of 15, 25, 20, 36 = 900.
G. C. D. of 2, 4, 3, 5 = 1.
Hence, L. C. M. of $7\frac{1}{2}, 6\frac{1}{4}, 6\frac{2}{3}, 7\frac{1}{5} = 900$ = No. minutes.

$900 \div 7\frac{1}{2} = 120$ No. times A walks around.
$900 \div 6\frac{1}{4} = 144$ " " B " "
$900 \div 6\frac{2}{3} = 135$ " " C " "
$900 \div 7\frac{1}{5} = 125$ " " D " "

REVIEW.

PAGE 107.—*Oral Exercise.*

15. The cost of the horse added to $\frac{2}{3}$ of the cost equals $\frac{5}{3}$ of the cost, or $180. $\frac{1}{3}$ of the cost is $\frac{1}{5}$ of $180, which is $36, and $\frac{3}{3}$, or the cost, is 3 times $36, or $108. The sleigh cost $\frac{2}{3}$ of $108, which is $72.

16. The height added to $\frac{3}{5}$ and $\frac{1}{4}$ of the height equals $\frac{33}{20}$ of the height, or 165 feet. $\frac{1}{20}$ of the height is $\frac{1}{33}$ of 165 feet, or 5 feet, and $\frac{20}{20}$, or the height, equals 20 times 5 feet, or 100 feet.

PAGE 108.

17. $\frac{2}{3}$ of 144 miles is 96 miles. If 96 miles is $\frac{12}{11}$ of the distance, $\frac{1}{11}$ is $\frac{1}{12}$ of 96 miles, and $\frac{11}{11}$, or the distance, is $\frac{11}{12}$ of 96 miles, or 88 miles.

18. $\frac{3}{5}$ of 90 miles is 54 miles. If 54 miles is $\frac{2}{3}$ of the distance, $\frac{1}{3}$ is $\frac{1}{2}$ of 54 miles, and $\frac{3}{3}$, or the distance, is $\frac{3}{2}$ of 54 miles, or 81 miles.

19. $\frac{12}{17}$ of 85 miles is 60 miles. If 60 miles is $\frac{12}{13}$ of

the distance, $\frac{1}{13}$ is $\frac{1}{12}$ of 60 miles, and $\frac{13}{13}$, or the distance, is $\frac{13}{12}$ of 60 miles, or 65 miles.

20. $\frac{7}{10}$ of 100 miles is 70 miles. If 70 miles is $\frac{7}{8}$ of the distance, $\frac{1}{8}$ is $\frac{1}{7}$ of 70 miles, and $\frac{8}{8}$, or the distance, is $\frac{8}{7}$ of 70 miles, or 80 miles.

21. $\frac{5}{6}$ of 150 miles is 125 miles; 125 miles, less 1 mile, or 124 miles, is $\frac{31}{20}$ of the distance; $\frac{1}{20}$ of the distance is $\frac{1}{31}$ of 124 miles, and $\frac{20}{20}$, or the distance, is $\frac{20}{31}$ of 124 miles, or 80 miles.

23. If $\frac{3}{4}$ of A's equals $\frac{5}{6}$ of B's, $\frac{1}{4}$ of A's is $\frac{1}{3}$ of $\frac{5}{6}$ of B's, or $\frac{5}{18}$ of B's, and $\frac{4}{4}$, or A's, is 4 times $\frac{5}{18}$ of B's, or $\frac{20}{18}$ of B's. $\frac{20}{18}$ of B's plus B's equals $\frac{38}{18}$ B's, which equals both, or \$380. $\frac{1}{18}$ of B's is $\frac{1}{38}$ of \$380, or \$10, and $\frac{18}{18}$, or B's, is 18 times \$10, which is \$180. $\frac{20}{18}$ of B's, which equals A's, is 20 times \$10, or \$200.

25. If $\frac{4}{9}$ C's $=\frac{4}{5}$ D's, $\frac{1}{9}$ C's $=\frac{1}{4}$ of $\frac{4}{5}$ D's, or $\frac{1}{5}$ D's, and $\frac{9}{9}$ C's $=9$ times $\frac{1}{5}$ D's, or $\frac{9}{5}$ D's. If $\frac{3}{4}$ D's age is 30 years, $\frac{4}{4}$, or D's age, is $\frac{4}{3}$ of 30 years, or 40 years, and C's age is $\frac{9}{5}$ of 40 years, or 72 years.

30. 14 bushels of clover-seed at \$5$\frac{1}{2}$ a bushel are worth 14 times \$5$\frac{1}{2}$, or \$77. As many pairs of shoes at \$2$\frac{1}{5}$ a pair can be bought for this amount as 2$\frac{1}{5}$ is contained times in 77, or 35 pairs.

PAGE 109.—*Written Problems.*

(11.) $44\frac{3}{5}+9\frac{1}{6}=53\frac{23}{30}$
$53\frac{23}{30}-33\frac{1}{8}=20\frac{77}{120}$.

(12.) $\frac{4}{13}\times\frac{91}{5}\times\frac{4}{7}\times\frac{223}{5}=\frac{3568}{25}=142\frac{18}{25}$.

(13.) $(\frac{3}{4}\times\frac{10}{3})\div(\frac{5}{9}\times\frac{15}{16})=\frac{3}{4}\times\frac{10}{3}\times\frac{9}{5}\times\frac{16}{15}=\frac{24}{5}=4\frac{4}{5}$.

(14.) $(\frac{4}{7}\times\frac{2}{9})\div(\frac{1}{5}\text{ of }\frac{15}{4})=\frac{4}{7}\times\frac{2}{9}\times\frac{5}{1}\times\frac{4}{15}=\frac{32}{189}$.

(15.) $\frac{127}{2}+\frac{3}{4}\text{ of }\frac{22}{3}=\frac{127}{2}+\frac{11}{2}=\frac{138}{2}$
$\frac{5}{9}\text{ of }\frac{81}{5}-\frac{5}{6}\text{ of }\frac{7}{2}=9-\frac{35}{12}=\frac{73}{12}$
$\frac{138}{2}\div\frac{73}{12}=\frac{138}{2}\times\frac{12}{73}=\frac{828}{73}=11\frac{25}{73}$.

(17.) $183 \times \$97\frac{1}{2} = \$17842\frac{1}{2}$
$43\frac{1}{2} \times \$122\frac{3}{4} = 5339\frac{5}{8}$
$\$23182\frac{1}{8}$, Total cost.

(18.) $\frac{4}{5}$ of $\frac{2}{3} = \frac{8}{15} = \$26320$
$\frac{1}{15} = \frac{1}{8}$ of $\$26320 = \$3290$
$\frac{15}{15} = 15 \times \$3290 = \$49350.$

(20.) $\dfrac{197\frac{1}{2} \times 137\frac{1}{2}}{493\frac{3}{4}} = \dfrac{\frac{395}{2} \times \frac{275}{2}}{\frac{1975}{4}} = \frac{395}{2} \times \frac{275}{2} \times \frac{4}{1975} = 55.$

(21.) $\frac{2}{3}$ of $\$\frac{651}{2} = \$217$; $\$217 + \$18\frac{1}{4} = \$235\frac{1}{4}.$

(22.) $\frac{3}{4}$ of $\$125 = \$93\frac{3}{4}$; $\$93\frac{3}{4} - \$21\frac{1}{2} = \$72\frac{1}{4}$ = Cost of cow.
$\$72\frac{1}{4} - \$61\frac{1}{5} = \$11\frac{1}{20}$ = Cost of sheep.
$\$125 + \$72\frac{1}{4} + \$11\frac{1}{20} = \$208\frac{3}{10}$ = Cost of all.

PAGE 110.

(23.) $\frac{1}{4}$ of 150 yds. $= 37\frac{1}{2}$ yds. = A's.
$\frac{1}{3}$ of 150 yds. = 50 yds. = B's.
$\frac{1}{5}$ of 150 yds. = 30 yds. = C's.
$37\frac{1}{2}$ yds. + 50 yds. + 30 yds. $= 117\frac{1}{2}$ yds. = Sold to all.
150 yds. $- 117\frac{1}{2}$ yds. $= 32\frac{1}{2}$ yds. = Remainder.

(24.) $\frac{2}{3} - \frac{2}{5} = \frac{4}{15}$
$\frac{5}{9} + \frac{4}{15} = \frac{25}{45} + \frac{12}{45} = \frac{37}{45} = \$4551.$
$\frac{1}{45} = \frac{1}{37}$ of $\$4551 = \$123.$
$\frac{45}{45} = 45 \times \$123 = \$5535.$

(25.) $\frac{3}{5}$ of $\frac{3}{4} = \frac{9}{20}$; $\frac{3}{4} - \frac{9}{20} = \frac{6}{20}$, or $\frac{3}{10}$ = A's remainder.
$\frac{2}{3}$ of $\frac{9}{20} = \frac{3}{10}$ = C's.
$\frac{9}{20} - \frac{3}{10} = \frac{3}{20}$ = B's.

(26.) $\frac{3}{4} \times \$5000 = \$3750$; $\frac{7}{8}$ of $\$3750 = \$3281\frac{1}{4}.$

(27.) $137\frac{1}{2} \div 3\frac{1}{8} = 44$, No. of coats.
$137\frac{1}{2} \div 2\frac{3}{4} = 50$, " pairs of pants.
$137\frac{1}{2} \div 1\frac{1}{4} = 110$, " vests.

COMPARISON OF NUMBERS.

CASE I.—PAGE 111.—*Oral Exercise.*

6. If 4 yards of carpet cost $3\frac{1}{5}$ dollars, 1 yard will cost $\frac{1}{4}$ of $3\frac{1}{5}$ dollars, or $\frac{4}{5}$ of a dollar, and 20 yards will cost 20 times $\frac{4}{5}$ of a dollar, or $\frac{80}{5}$ dollars, which equals 16 dollars. If he pay 20 dollars, he will receive as change 20 dollars less 16 dollars, or 4 dollars.

Written Problems.

(5.) $\frac{1}{2}$ of \$11 = \$$5\frac{1}{2}$ = Cost of 1 pr. of boots.
12 × \$$5\frac{1}{2}$ = \$66 = " 12 prs. "
$\frac{1}{5}$ of \$6 = \$$1\frac{1}{5}$ = Cost of 1 yd. carpet.
27 × \$$1\frac{1}{5}$ = \$$32\frac{2}{5}$ = " 27 yds.
\$66 + \$$32\frac{2}{5}$ = \$$98\frac{2}{5}$, or \$98.40.

(6.) $\frac{1}{16}$ of $11\frac{3}{5} = \frac{1}{16}$ of $\frac{58}{5} = \frac{29}{40}$, the No. of bushels that can be bought for \$1.
105 × $\frac{29}{40}$ bu. = $76\frac{1}{8}$ bu. *Ans.*

CASE 2.—PAGE 112.—*Oral Exercise.*

7. If I have lived $\frac{2}{5}$ of my life since I became 21 years of age, previous to that time I lived $\frac{5}{5}-\frac{2}{5}$, or $\frac{3}{5}$ of my life, or 21 years. $\frac{1}{5}$ of my age is therefore $\frac{1}{3}$ of 21 years, or 7 years, and $\frac{5}{5}$, or my age, is 5 times 7 years, or 35 years.

Written Problems.

(4.) $35 \div 6\frac{1}{4} = 35 \times \frac{4}{25} = \frac{28}{5}$
46 × \$$\frac{28}{5}$ = \$$\frac{1288}{5}$ = \$$257\frac{3}{5}$.

(5.) $\frac{1}{12} = \frac{1}{7}$ of \$10.50 = \$1.50.
$\frac{12}{12}$ = 12 × \$1.50 = \$18, Cost of 1 ton.
25 T. = 25 × \$18 = \$450.

(6.) $\frac{1}{8}$ pound cost $\frac{1}{7}$ of 64 cents = $\frac{64}{7}$ cents.
$\frac{8}{8}$, or 1 pound, cost 8 × $\frac{64}{7}$ cents = $\frac{512}{7}$ cents.
28 pounds cost 28 × $\frac{512}{7}$ cents = 2048 cents.

CASE III.—PAGE 113.—*Oral Exercise.*

6. If 12 dozen buttons are worth $1.08, one dozen is worth $\frac{1}{12}$ of $1.08, or 9 cents, and $\frac{3}{4}$ of a dozen are worth $\frac{3}{4}$ of 9 cents, or $\frac{27}{4}$ cents, which is equal to $6\frac{3}{4}$ cents.

7. If 7 bushels of potatoes cost $5\frac{3}{5}$, or $\frac{28}{5}$, dollars, 1 bushel will cost $\frac{1}{7}$ of $\frac{28}{5}$ dollars, or $\frac{4}{5}$ of a dollar, and $\frac{7}{8}$ of a bushel will cost $\frac{7}{8}$ of $\frac{4}{5}$ of a dollar, which is $\frac{7}{10}$ of a dollar.

Written Problems.

(3.) $\frac{1}{43}$ of $354\frac{3}{4} = \frac{1}{43} \times \frac{1419}{4} = \frac{33}{4}$.
$\frac{25}{2} \times \frac{33}{4} = \frac{825}{8} = 1803\frac{1}{8}$. *Ans.*

(4.) $\frac{1}{27}$ of $364\frac{1}{2} = \frac{1}{27} \times \frac{729}{2} = 13\frac{1}{2}$.
$13\frac{1}{2} + 3\frac{1}{2} = 17$ = Selling price of a dozen.
7 × 17 cents equal 119 cents. *Ans.*

(5.) $\frac{1}{40} \times \$4500 = \$112\frac{1}{2}$, Cost of 1 acre.
$\$112\frac{1}{2} + \$12\frac{1}{2} = \$125$, Selling price per acre.
$32\frac{1}{2} \times \$125 = \$4062\frac{1}{2}$. *Ans.*

(6.) $3\frac{3}{4} \times 220$ lbs. = 825 lbs.
825 × 12¢ = 9900¢ = Received for $3\frac{3}{4}$ barrels.
$12 - 3\frac{3}{4} = 8\frac{1}{4}$. No. barrels remaining.
$8\frac{1}{4} \times 220 = 1815$. No. lbs. remaining.
$1815 \times 11\frac{1}{2}$¢ = $20872\frac{1}{2}$¢ = Received for $8\frac{1}{4}$ barrels.
9900¢ + $20872\frac{1}{2}$¢ = $30772\frac{1}{2}$¢ = Received for all.
$30772\frac{1}{2}$¢ − 28380¢ = $2392\frac{1}{2}$¢. *Ans.*

CASE IV. PAGE 114.—*Oral Exercise.*

7. If $\frac{5}{6}$ of a bushel cost 90 cents, $\frac{1}{6}$ of a bushel cost $\frac{1}{5}$ of 90 cents, which is 18 cents, and $\frac{6}{6}$, or a bushel, cost 6 times 18 cents, which is 108 cents. If 1 bushel cost 108 cents, $3\frac{1}{2}$ bushels cost $3\frac{1}{2}$ times 108 cents, or 378 cents.

Written Problems.

(5.) $5\frac{3}{4} \div 7\frac{3}{16} = \frac{23}{4} \times \frac{16}{115} = \frac{4}{5}$ yd. = Amt. of delaine for 1 lb. of butter.

$17\frac{1}{4} \times \frac{4}{5} = \frac{69}{5}$, or $13\frac{4}{5}$ yds. *Ans.*

(6.) $6\frac{1}{5} \div 18\frac{6}{10} = \frac{31}{5} \times \frac{10}{186} = \frac{1}{3}$ T. = Amt. of hay for 1 ton of coal,

$15\frac{1}{4} \times \frac{1}{3} = \frac{61}{12}$, or $5\frac{1}{12}$ T. *Ans.*

CASE V. PAGE 115.—*Oral Exercise.*

4. $\frac{1}{4} + \frac{1}{5} + \frac{3}{8} = \frac{33}{40}$; $\frac{40}{40} - \frac{33}{40} = \frac{7}{40}$, which is the remainder, equal to 35 pounds. $\frac{1}{40}$ equals $\frac{1}{7}$ of 35 pounds, which is 5 pounds, and $\frac{40}{40}$, or the whole barrel, equals 40 times 5 pounds, which is 200 pounds.

7. $\frac{1}{3}$ of $\frac{1}{2} = \frac{1}{6}$; $\frac{4}{9}$ plus $\frac{1}{6}$ equals $\frac{11}{18}$, which equals $99. $\frac{1}{18}$ of his money is $\frac{1}{11}$ of $99, or $9, and $\frac{18}{18}$ equals 18 times $9, or $162.

8. If he lost $\frac{3}{4}$ of his money, he had remaining $\frac{1}{4}$. He then found $\frac{1}{5}$ of $\frac{3}{4}$, or $\frac{3}{20}$, of his money. $\frac{1}{4}$ plus $\frac{3}{20}$ equals $\frac{8}{20}$, or $\frac{2}{5}$, which is $36; $\frac{1}{5}$ of his money is $\frac{1}{2}$ of $36, or $18, and $\frac{5}{5}$, or the money, is 5 times $18, or $90.

9. If John found 20 cents, and lost $\frac{4}{5}$ of it, he had remaining more than at first $\frac{1}{5}$ of 20 cents, or 4 cents. $\frac{5}{4} - \frac{4}{4}$, or $\frac{1}{4}$, of his money, equals 4 cents, and $\frac{4}{4}$, or his money, equals 4 times 4 cents, or 16 cents.

10. If a farmer sold $\frac{1}{3}$ of his cattle he had $\frac{2}{3}$ remaining. He bought $\frac{2}{3}$ as many as he sold; hence he bought $\frac{2}{3}$ of $\frac{1}{3}$ of his number at first, which is $\frac{2}{9}$ of his number at first. $\frac{2}{3}$ plus $\frac{2}{9}$, or $\frac{8}{9}$, of his cattle equals 40. $\frac{1}{9}$ is $\frac{1}{8}$ of 40, or 5, and $\frac{9}{9}$ is 9 times 5, or 45.

11. $\frac{1}{3} + \frac{1}{4} + \frac{1}{5}$ equals $\frac{47}{60}$; $\frac{60}{60}$ minus $\frac{47}{60}$, or $\frac{13}{60}$, equals 26 trees. $\frac{1}{60}$ equals $\frac{1}{13}$ of 26, or 2, and $\frac{60}{60}$, the whole number of trees, is 60 times 2, or 120 trees.

12. If the balloon first fell $\frac{1}{3}$ of the distance, it remained up $\frac{2}{3}$ of the distance; it then rose $\frac{1}{4}$ of $\frac{2}{3}$, or $\frac{1}{6}$, of the distance, which added to $\frac{2}{3}$ is $\frac{5}{6}$ of the distance. It then fell $\frac{1}{5}$ of $\frac{5}{6}$, or $\frac{1}{6}$, of the distance, and remained up $\frac{5}{6}-\frac{1}{6}$, or $\frac{4}{6}$, of the distance, or 400 feet. $\frac{1}{6}$ of the distance is $\frac{1}{4}$ of 400 feet, which is 100 feet, and $\frac{6}{6}$, or the distance, is 6 times 100 feet, or 600 feet.

Page 116.—*Written Problems.*

(3.) $\frac{3}{4}\times\frac{6}{10}=\frac{9}{20}$, the amount expended.
$\frac{20}{20}-\frac{9}{20}=\frac{11}{20}=\$1375$.
$\frac{1}{20}=\frac{1}{11}$ of $\$1375=\$125$.
$\frac{20}{20}=20\times\$125=\$2500$.

(5.) $\frac{1}{4}+\frac{1}{5}=\frac{9}{20}$. Paid for store and house.
$\frac{20}{20}-\frac{9}{20}=\frac{11}{20}=\$9020$.
$\frac{1}{20}=\frac{1}{11}$ of $\$9020=\$820$.
$\frac{20}{20}=20\times\$820=\$16400=$ His money.
$\frac{1}{4}$ of $\$16400=\$4100=$ Paid for store.
$\frac{1}{5}$ of $\$16400=\$3280=$ Paid for house.

DECIMAL FRACTIONS.

REDUCTION OF DECIMALS. Page 120.

(2.) $.625=\frac{625}{1000}=\frac{5}{8}$.
(3.) $.025=\frac{25}{1000}=\frac{1}{40}$.
(4.) $.404=\frac{404}{1000}=\frac{101}{250}$.
(5.) $.005=\frac{5}{1000}=\frac{1}{200}$.
(6.) $.1250=\frac{1250}{10000}=\frac{1}{8}$.
(7.) $.0008=\frac{8}{10000}=\frac{1}{1250}$.
(8.) $.648=\frac{648}{1000}=\frac{81}{125}$.
(9.) $3.25=3\frac{25}{100}=3\frac{1}{4}$.
(10.) $32.5=32\frac{5}{10}=32\frac{1}{2}$.
(11.) $16.25=16\frac{25}{100}=16\frac{1}{4}$.
(12.) $56.375=56\frac{375}{1000}=56\frac{3}{8}$.
(13.) $56.37\frac{1}{2}=56\frac{37\frac{1}{2}}{100}=56\frac{75}{200}=56\frac{3}{8}$.

(14.) $56.3\frac{3}{4} = 56\frac{3\frac{3}{4}}{10} = 56\frac{15}{40} = 56\frac{3}{8}$.

(15.) $.33\frac{1}{3} = \frac{33\frac{1}{3}}{100} = \frac{1}{3}$.

(16.) $27.66\frac{2}{3} = 27\frac{66\frac{2}{3}}{100} = 27\frac{200}{300} = 27\frac{2}{3}$.

(17.) $.56\frac{1}{4} = \frac{56\frac{1}{4}}{100} = \frac{225}{400} = \frac{9}{16}$.

(19.) $.857142\frac{6}{7} = \frac{857142\frac{6}{7}}{1000000} = \frac{6000000}{7000000} = \frac{6}{7}$.

CASE III.

1, *Oral.* In 1 there are $\frac{10}{10}$, and in $\frac{1}{5}$ there are $\frac{1}{5}$ of $\frac{10}{10}$, or $\frac{2}{10}$.

PAGE 121.—*Written Problems.*

(8.) $\frac{21}{40} = \frac{1}{40}$ of $21.000 = .525$.
Hence, $3\frac{21}{40} = 3.525$.

(9.) $\frac{3}{4} = \frac{1}{4}$ of $3.00 = .75$.
Hence, $37\frac{3}{4} = 37.75$.

(23.) $\frac{5}{400} = \frac{5.0000}{400} = .0125$.

(24.) $24\frac{1}{125} = 24\frac{1.000}{125} = 24.008$.

(25.) $12\frac{16}{21} = 12\frac{16.0000}{21} = 12.7619\frac{1}{21}$.

ADDITION OF DECIMALS.

PAGE 122.

(10.)	(11.)	(12.)
34.883	16.375	.33
13.4072	12.6125	1.275
12.0734	14.003	.127
110.642	16.5	.5
8.0008	59.4905	1.324
179.0064		3.556

SUBTRACTION OF DECIMALS.

Page 122.

Note.—When there are not as many decimal places in the minuend as there are in the subtrahend, ciphers are supplied at the right, to make the number of places in the minuend equal that of the subtrahend.

(5.) $\begin{array}{r}621.00\\ 3.17\\ \hline 617.83\end{array}$ (7.) $\begin{array}{r}13.31750\\ 9.61478\\ \hline 3.70272\end{array}$ (8.) $\begin{array}{r}4256.85000\\ .00564\\ \hline 4256.84436\end{array}$

Page 123.

(9.) $\begin{array}{r}7.6420\\ 3.9375\\ \hline 3.7045\end{array}$ (10.) $127\frac{17}{20} = 127.85$ $\begin{array}{l}296.4005\\ 127.85\\ \hline 168.5505\end{array}$

(11.) $87\frac{1}{5} = 87.2$ $\begin{array}{l}87.200\\ 31.642\\ \hline 55.558\end{array}$ (12.) $1274\frac{1}{8} = 1274.125$ $\begin{array}{r}1274.125\\ 1232.625\\ \hline 41.5\end{array}$ *Ans.*

(13.) $\begin{array}{r}25\frac{3}{4} = 25.75\\ 18\frac{1}{5} = 18.2\\ \hline 7.55\end{array}$ (14.) $\begin{array}{r}\$18.860\\ 13.685\\ \hline \$5.175\end{array}$

MULTIPLICATION OF DECIMALS.

Page 123.

(4.) $\begin{array}{r}24.408\\ .0008\\ \hline .0195264\end{array}$ (6.) $\begin{array}{r}448.9\\ .008\\ \hline 3.5912\end{array}$ (9.) $\begin{array}{r}.37\\ 1000\\ \hline 370.00\end{array}$

(11.) $56.25 \times 17\frac{3}{4} = 56.25 \times 17.75 = 998.4375.$

(12.) $186.203 \times 18\frac{1}{5} = 186.203 \times 18.2 = 3388.8946.$

(13.) $16\frac{1}{8} \times 14.55 = 16.125 \times 14.55 = 234.61875.$

(14.) $277\frac{3}{8} \times 12.004 = 277.375 \times 12.004 = 3329.6095.$

(15.) $874\frac{9}{10} \times 163\frac{1}{16} = 874.9 \times 163.0625 = 142663.38125.$

(16.) 75 × 7.92 in. = 594 in.

(17.) 28 × \$1.25 = \$35.
200 × $.13\frac{3}{4}$ = \$27.50
\$7.50 = Balance.

DIVISION OF DECIMALS.

PAGE 125.

```
(7.) .025).018900(.756.
           .0175
            140
            125
             150
             150
```

```
(10.) 12.5)9.45500(.7564.
           875
            705
            625
             800
             750
              500
              500
```

(11.) $234.61875 \div 16\frac{1}{8} = 234.61875 \div 16.125 = 14.55.$

(12.) $998\frac{7}{16} \div 56.25 = 998.4375 \div 56.25 = 17.55.$

```
(13.) 100)1846.00(18.46
          100
           846
           800
            460
            400
             600
             600
```

```
(15.) 10000)16.0000(.0016
            10000
             60000
             60000
```

APPLICATION OF DECIMALS.

CASE I.—PAGE 126.

(5.)

$$\begin{array}{rrcr} 600{,}00 \times \$ & .30 & = & \$180.00{,}00 \\ 12{,}50 \times & 21.50 & = & \underline{26.87{,}50} \\ & & & \$206.8750 \end{array}$$

(6.)

$$\begin{array}{rrcr} 3{,}20 \times \$ & .40 & = & \$1.28{,}00 \\ 1{,}15 \times & 3.50 & = & \underline{4.02{,}50} \\ & & & \$5.305 \end{array}$$

(7.)

$$\begin{array}{rrcr} 15{,}520 \times \$ & 7.00 & = & \$108.64{,}000 \\ 5{,}760 \times & 12.50 & = & \underline{72.00{,}000} \\ & & & \$180.64 \end{array}$$

(8.)

$$\begin{array}{rrcr} 2{,}500 \times & \$27.50 & = & \$68.75{,}000 \\ 1{,}875 \times & 24.00 & = & 45.00{,}000 \\ 16{,}50 \times & .32 & = & 5.28{,}00 \\ 1{,}520 \times & 15.00 & = & 22.80{,}000 \\ 7{,}500 \times & 6.50 & = & \underline{48.75{,}000} \\ & & & \$190.58 \end{array}$$

CASE 2.—PAGE 127.

(7.)

$$\begin{array}{rcr} \dfrac{2520 \times \$22}{2000} & = & \$27.72 \\ \dfrac{1860 \times \$16.50}{2000} & = & \underline{15.345} \\ & & \$43.065 \end{array}$$

(9.)

$$130 \times 230 \text{ lbs.} = 29900 \text{ lbs.}$$

$$\frac{29900 \times \$25}{2000} = \$373.75.$$

(10.)
$$\begin{aligned}
\frac{18640 \times \$4.25}{2000} &= \$39.61\\
\frac{6350 \times 5.00}{2000} &= 15.875\\
\frac{1865 \times 25.00}{1000} &= 46.625\\
\frac{12000 \times .45}{100} &= \underline{54.00}\\
&\ \$156.11
\end{aligned}$$

PROBLEMS IN DECIMALS.

PAGE 128.

(3.)
$$\begin{array}{l}
64.803\\
\underline{10.7045}\\
75.5075\\
\underline{16.455}\\
59.0525.\ \textit{Ans.}
\end{array}$$

(5.)
$$\begin{aligned}
20. \times \$16.25 &= \$325.00\\
12.55 \times 17.75 &= \underline{\$222.7625}\\
&\ \$102.2375.\ \textit{Ans.}
\end{aligned}$$

(6.) 27.5 × 31.25 gal. = 859.375 gal.; 1000 − 859.375 = 140.625. *Ans.*

(7.) $11.48 − $9.43 = $2.05; 451 ÷ 2.05 = 220. *Ans.*

(8.) $9000 × .625 = $5625; .45 × $5625 = $2531.25. *Ans.*

(9.)
$$\begin{aligned}
\tfrac{3}{5} \text{ of } \$8800 &= \$5280\\
.40 \times \$5280 &= \$2112 = \text{A's.}\\
.35 \times 5280 &= \underline{1848} = \text{B's.}\\
&\ 3960 = \text{Both.}\\
\$5280 - \$3960 &= \$1320 = \text{C's.}
\end{aligned}$$

(10.)
$$\begin{aligned}
\frac{17840 \times \$7.50}{1000} &= \$133.80, \text{ Value of bricks.}\\
43 \times \$2.75 &= \underline{118.25}, \text{ Value of labor.}\\
&\ \$252.05.\ \textit{Ans.}
\end{aligned}$$

(11.)

$$\begin{array}{r} \$26.50 \\ 2.375 \\ 40.625 \\ 12.50 \\ 26.25 \\ \hline 108.25 \end{array}\text{, Paid out.}$$

$$\frac{850\times\$5.25}{100}=\$44.625$$

$$\frac{1275\times .75}{100}=\quad 9.5625$$

$$\frac{840\times .15}{12}=\quad 10.50$$

$$325\times\$1.75=\underline{568.75}$$

$$633.4375\text{, Rec'd.}$$

$$\$633.4375-\$108.25=\$525.1875.\quad \text{Profit.}$$

(12.)

$$\begin{array}{r} 2840 \\ 2725 \\ 2742 \\ 2930 \\ 2563 \\ \hline 13800 \end{array}$$

$$\frac{13800\times\$5.75}{2000}=\$39.675\text{, Val. of coal.}$$

$$\frac{1554\times\$18.50}{1000}=\quad \underline{28.749}\text{, Val. of boards.}$$

$$\$10.926.\quad \textit{Ans.}$$

PAGE 129.

(13.)

$$\frac{23500\times\$8.50}{1000}=\$199.75$$

$$\frac{6850\times\$15.00}{1000}=\quad 102.75$$

$$\frac{8040\times\$22.50}{1000}=\quad 180.90$$

$$\frac{6500\times\$7.25}{1000}=\quad 47.125$$

$$\frac{2500\times\$.30}{100}=\quad \underline{7.50}$$

$$\begin{array}{r} 538.025 \\ 742.50 \\ \hline \$1280.525 \end{array}\text{, Cost.}$$

$$\$1800-\$1280.525=\$519.475=\text{Gain.}$$

(14.)
4235
4285
4080
12600

$\frac{12600 \times \$5.80}{2000} = \$36.54$, Val. of coal.

$36.54 \div .63 = 58.$ *Ans.*

DENOMINATE NUMBERS.

ENGLISH CURRENCY, PAGE 131.

5, *Oral.* How many pence in 1 £ 6 s. 6 d.?

In 1 £ there are 20 s.; 20 s. + 6 s. are 26 s. In 1 s. there are 12 d., and in 26 d. there are 26 times 12 d., or 312 d.; 312 d. plus 6 d. are 318 d.

Written Problems.

(4.) 18 £ 10 s. 5 d.
20
360
10
370 s.
12
4440
5
4445 d.

(6.) 4)16842 far.
12)4210 d. 2 far.
20)350 s. 10 d.
17 £ 10 s.

Hence, 16842 far. = 17 £ 10 s. 10 d. 2 far.

WEIGHT.

PAGE 133.

5, *Oral.* 1 T. equals 20 cwt.; 20 cwt. + 3 cwt. = 23 cwt. 23 cwt. at 80 cents a hundred-weight are worth $18.40. If delaine is worth 40 cents a yard, as many yards can be bought for $18.40 as 40 is contained times in 1840, or 46 yards.

Written Problems.

(5) $1 \text{ oz.} = \frac{1}{16} \text{ lb.}$
$4 \text{ oz.} = \frac{4}{16} \text{ lb.} = \frac{1}{4} \text{ lb.}$
$2\frac{1}{4} \times 30¢ = 67\frac{1}{2}¢.$

(6.) $3 \text{ lbs. } 5 \text{ oz.} = 3\frac{5}{16} \text{ lbs.}$
$3\frac{5}{16} \times 22¢ = 72\frac{14}{16}¢.$

(9.) $$\frac{16840 \times \$1.20}{60} = \$336.80.$$

(10.) $$64 \times 183\frac{1}{2} \text{ lb.} = 11744 \text{ lb.}$$
$$\frac{11744 \times \$1.30}{60} = \$254.45\frac{1}{3}.$$

Page 134.

6, *Oral.* An ounce of silver weighs 480 grains by Troy weight, and an ounce of salt weighs 437½ grains by Avoirdupois. An ounce of silver is therefore 42½ grains heavier.

7, *Oral.* A pound of feathers weighs 7000 grains, and a pound of gold 5760 grains; hence a pound of feathers is 1240 grains heavier than a pound of gold.

Written Problems.

(4.) 24)84150 gr.
20)3506 dwt. 6 gr.
12)175 oz. 6 dwt.
14 lb. 7 oz.

(7.) 1 oz. 5 dwt. = 25 dwt.
$25 \times 85¢ = \$21.25.$

(5.) $13\frac{3}{4} \times 5760 \text{ gr.} = 79200 \text{ gr.}$

(6.) 240 dwt. = 1 lb.
$9\frac{1}{2} \times 240 \text{ dwt.} = 2280 \text{ dwt.}$
$2280 \times 6\frac{3}{5}¢ = \$150.48.$

(8.) 4 ℥ = 96 ℈
$96 \times 2¢ = \$1.92.$

EXTENSION.

Page 137.

8, *Oral.* If a man travel 20 leagues a day, he travels 20 times 3 miles, or 60 miles; hence to travel 2400 miles will require as many days as 60 is contained times in 2400, or 40 days.

9, *Oral.* At 60 cents a foot, 1 yard will cost 3 times 60 cents, or $1.80, and $5\frac{1}{2}$ yards, or a rod, will cost $5\frac{1}{2}$ times $1.80, which is $9.90. If 1 rod of fence cost $9.90, 4 rods will cost 4 times $9.90, or $39.60.

Written Problems.

(7.) 3)640 ft.
5.5)213 yd. 1 ft.
38 rd. 4 yd.

(8.) 12)1200 in.
3)100 ft.
5.5)33 yd. 1 ft.
6 rd.

(9.) $15\frac{1}{2} \times 4$ in. = 62 in. = 5 ft. 2 in.

(10.) $\frac{11}{3}$ in. − $\frac{6}{3}$ in. = $\frac{5}{3}$ in. = $1\frac{2}{3}$ in.

(11.) 10 × 6 ft. = 60 ft.

PAGE 138.

(3.) 10 × 4 rd. = 40 rd.
40 × $5\frac{1}{2}$ yd. = 220 yd.
220 × 3 ft. = 660 ft.

(4.) 16 + 14 + 15.25 + $12.33\frac{1}{3}$ = $57.58\frac{1}{3}$
$57.58\frac{1}{3} \times 4 \times 5\frac{1}{2} \times 3$ ft. = $3800\frac{1}{2}$ ft. Dist. around.

PAGE 140.—*Written Problems.*

(3.) 40 × 12 = 480; 480 ÷ 160 = 3. *Ans.*

(4.) 14 rd. 6 ft. = 237 ft.
12 rd. 3 ft. = 201 ft.
237 ft. × 201 ft. = 47637 sq. ft.

9)47637 sq. ft.
30.25)5293 sq. yd. (174 sq. rd.
3025
22680
21175
150.50
121.00
29.50 = $29\frac{1}{2}$ sq. yd. = 29 sq. yd. 4. sq. ft. 72 sq. in.

160)174 sq. rd.
1 A. 14 rd.

(5.) 12 × \$200 = \$2400
12 × 43560 × 8¢ = \$41817.60
\$41817.60 − \$2400 = \$39417.60.

(6.) $60 \times 160 = 9600$
$9600 \times \frac{1}{43560}$ A. = $\frac{80}{363}$ A.

(7.) $25 \times 120 = 3000$
$3000 \times \frac{1}{43560}$ A. = $\frac{25}{363}$ A.

VOLUME.

Page 141.—*Written Problems.*

(4.) $20 \times 4 \times 6 = 480$; $480 \div 128 = 3\frac{3}{4}$, No. of cords.

(5.) A 6 in. cube = 216 cu. in.; 216 cu. in. − 6 cu. in. = 210 cu. in.

(6.) $6 \times 4 \times 3 = 72$, No. of cu. ft.

(7.) $6 \times 8 \times 4 = 192$. A 2 ft. cube = 8 cu. ft.
$192 \div 8 = 24$. *Ans.*

(8.) $20 \times 6 \times 3 = 360$; $360 \div 24\frac{3}{4} = 14\frac{6}{11}$, No. of perch.

CAPACITY.

Page 142.

6, *Oral.* 5 gal. 1 pt. equal $5\frac{1}{8}$ gal. If 1 gallon cost 80 cents, $5\frac{1}{8}$ gallons will cost $5\frac{1}{8}$ times 80 cents, or \$4.10.

Page 143.

5, *Oral.* In 1 bushel there are 4 pecks, and in 3 bushels 3 times 4 pecks, or 12 pecks; 12 pecks and 3 pecks are 15 pecks. In 1 peck there are 8 quarts, and in 15 pecks there are 15 times 8 quarts, or 120 quarts; 120 quarts plus 3 quarts are 123 quarts. In 1 quart there are 2 pints, and in 123 quarts 123 times 2 pints, or 246 pints.

Written Problems.

(3.) 2)17632 pt.
8)8816 qt.
4)1102 pk.
$275\frac{1}{2}$ bu.

(4.) 1 qt. wine = $\frac{1}{4}$ of 231 cu. in. = $57\frac{3}{4}$ cu. in.
1 " clover-seed = $\frac{1}{32}$ of 2150.42 cu. in. = 67.20 + cu. in.
67.20 + cu. in. − 57.75 cu. in. = 9.45 + cu. in.

(5). 5 × $4 = $20.
5 × 32 qt. = 160 qt.; 160 × 15¢ = $24.00
$24 − $20 = $4 = Gain.

(6.) 3 × $2 = $6
3 × 2150.42 cu. in. = 6451.26 cu. in.
6451.26 ÷ 57.75 = 111.7, No. liquid qt. in 3 bu.
111.7 × 10¢ = $11.17; $11.17 − $6 = $5.17 = Gain.

TIME.

Page 146.

	yr.	m.	d.	
(4.)	1874	12	9	
	1836	1	2	
	38	11	7	*Ans.*

(6.) *Ans.* 1872, 1876, 1908, 2000, 1840, 1600, 1820.

(7.) 11 hr. 15 min.
8 " 40 "
2 hr. 35 min. *Ans.*

(8.) 14 hr. 20 min.
7 " 45 "
6 hr. 35 min. *Ans.*

(9.) *Ans.* 24, since 1900 is not a leap-year.

COUNTING.

PAGE 148.—*Oral Exercise.*

6. If 1 sheet quarto makes 8 pages, to make a volume of 160 pages will require as many sheets as 8 is contained times in 160, or 20 sheets.

7. If 1 sheet octavo makes 16 pages, to make an octavo volume of 240 pages will require as many sheets as 16 is contained times in 240, or 15 sheets.

8. If 1 sheet 12mo makes 24 pages, to make a 12mo volume of 252 pages will require as many sheets as 24 is contained times in 252, or 10½ sheets.

9. A quarto of 80 pages contains ⅛ of 80 sheets, which is 10 sheets. If 1 sheet makes 32 pages of a 16mo volume, 10 sheets will make 10 times 32 pages, or 320 pages.

REDUCTION.

PAGE 150.

(7.) 10 sq. rd. 3½ sq. ft.
272¼
2722½
3½
2726 sq. ft
2726 × 144 sq. in. = 392544 sq. in.

(8.) 12 T. 3 cwt. 10 lb.
20
243 cwt.
100
24310 lb.

(9.) Year 1876
= 366 d.
24
1464
732
8784 hr.
60
527040 min.

(10.) 16 cd. 3 cu. ft.
128
128
32
16 3
2051 cu. ft.

(12.)
$$\begin{array}{l} 12\text{ lb. }6\text{ oz. }3\text{ dwt.}\\ \underline{\;12\;}\\ 150\text{ oz.}\\ \underline{\;\;20\;}\\ 3003\text{ dwt.}\end{array}$$

(14.)
$$\begin{array}{l} 8\text{ bu. }2\text{ pk. }2\text{ qt. }1\text{ pt.}\\ \underline{\;\;4\;}\\ 34\text{ pk.}\\ \underline{\;\;\;8\;}\\ 274\text{ qt.}\\ \underline{\;\;\;2\;}\\ 549\text{ pt.}\end{array}$$

(15.)
$$\begin{array}{l} 3\text{ lb. }6\text{ oz.}\\ \underline{12}\\ 42\text{ oz.}\\ \underline{\;20\;}\\ 840\text{ dwt. @ }80¢ = \$672.\end{array}$$

(16.) 1001 bu. = 4004 pk.
2 bu. 3 pk. = 11 pk.
4004 ÷ 11 = 364. *Ans.*

(17.) $\frac{6 \times 220}{8} = 165.$ *Ans.*

(18.) 4 × \$.25 = \$1.00, Received per gallon.
\$1.00 − \$.80 = \$.20
60 × \$.20 = \$12.00.

(19.) 63 × 4 × 2 pt. = 504 pt.

(21.) 12 × \$4.8665 = \$58.398.

(22.) Jan. and Feb., 1876 = 60 d. 60 × 24 × 60 × 60 sec. = 5184000 sec.

(23.) 3 miles = 3 × 5280 ft. = 15840 ft.
15840 ÷ 15 = 1056. *Ans.*

(24.) 20 × 24 pp. = 480 pp.

(25.) 64 × 8¢ = \$5.12, Selling price.
\$5.12 − \$3.50 = \$1.62, Gain per bu.
12 × \$1.62 = \$19.44. *Ans.*

PAGE 151.—*Oral Exercise.*

18. There are 10 sq. ch. in 1 acre; hence, in 60 sq. ch. there are as many acres as 10 is contained times in 60, or 6 acres.

19. In 1 lb. Troy there are 12 oz.; hence, in 48 oz. there are as many pounds as 12 is contained times in 48, or 4 lbs. Since there are 16 oz. in 1 lb. avoirdupois, there are as many pounds in 48 oz. as 16 is contained times in 48, or 3 lbs.

20. Since there are 24 hours in a day, in 1800 hours there are as many days as 24 is contained times in 1800, or 75 days, and as many weeks as 7 is contained times in 75, or 10 weeks and 5 days.

PAGE 153.—*Written Problems.*

(18.) 7920 ÷ 60 = 132, No. of bushels.
132 × \$1.30 = \$171.60.

(19.) Jan., Feb, Mar., and April, 1876 = 121 d.
121 × 24 × 5¢ = \$145.20. *Ans.*

(20.) 5390 ÷ .11 = 49000, No. of lbs., = 24½ T. *Ans.*

(21.) 27 × 18 × 20 = 9720.
9720 cu. in. = 5 cu. ft. 1080 cu. in.

(22.) 12 × 196 lbs. = 2352 lbs. 2352 × 4¢ = \$94.08.

(23.) 8 × 12¢ = 96¢, Selling price per gal.
96¢ − 60¢ = 36¢, Gain " "
3 × 36 × 36¢ = \$38.88. *Ans.*

COMPOUND NUMBERS.

ADDITION, PAGE 154.

Answers.

(1.) 41 £.

(2.) 284 £ 13 s. 4 d.

(3.) 968 £ 1 s. 5 d.

(4.) 95 £ 17 s. 4 d.

(5.) 130 bu. 3 qt. 1 pt.

(6.) 3 bu. 5 qt.

(7.) 26 yd. 1 ft. 11 in.

(8.) 51 d. 2 hr. 56 min.

(9.) 67 lb. 10 oz. 19 dwt.

(10.) 2 lb. 2 ℥ 1 ʒ 2 ℈ 16 gr.

(11.) 227 cwt. 3 qr. 2 lb. 14 oz. 4 dr.

(17.) 12 mi. 5 fur. 39 rd. 12 ft. 7 in.
16 " 6 " 18 " 5 " 7 "
10 " 5 " 32 " 4 " 6 "
40 mi. 2 fur. 10 rd. 5½ ft. 8 in. *Ans.*
But 5½ ft. = 1 yd. 2 ft. 6 in.
Hence, *Ans.* = 40 mi. 2 fur. 10 rd. 1 yd. 2 ft. 14 in.
Or, 40 mi. 2 fur. 10 rd. 2 yd. 0 ft. 2 in.

(19.) 3 mi. 3 fur. 9 rd. 3 yd.
6 " 1 " 0 " 2 " 6 in.
9 mi. 4 fur. 9 rd. 5 yd. 6 in.

SUBTRACTION OF COMPOUND NUMBERS.

PAGE 156.

Answers.

(1.) 21 £ 8 s. 7 d. 2 far.

(2.) 7 £ 19 s. 6d. 2 far.

(3.) 6 lb. 18 dwt. 3 gr.

(4.) 36 lb. 2 oz. 4 dwt. 22 gr.

(5.) 7 yr. 8 mo. 3 wk. 4 d.

(6.) 4 mi. 49 rd. 14½ ft.

(7.) 2 bbl. 26½ gal. 2 qt. 1 pt. = 2 bbl. 27 gal. 1 pt.

(8.) 1 bu. 2 pk. 6 qt.

PAGE 157.

(10.) 16 bu. 0 pk. 0 qt.
3 " 3 " 3 "
12 bu. 0 pk. 5 qt. *Ans.*

(12.) 36 gal. 0 qt. 0 pt.
13 " 2 " 1 "
22 gal. 1 qt. 1 pt. *Ans.*

(15.) 107 bu. 3 pk. 0 qt. 0 pt.
190 " 0 " 0 " 1 "
297 bu. 3 pk. 0 qt. 1 pt.
250 " 2 " 5 "
47 bu. 0 pk. 3 qt. 1 pt. *Ans.*

(16.) 10 × 206 lb. = 2060 lb.
2060 lb. 0 oz.
1615 " 6 "
444 lb. 10 oz. *Ans.*

(17.) 16 cd. 3 cu. ft.
19 " 3 "
27 " 18 "
62 cd. 24 cu. ft.
50 " 3 "
12 cd. 21 cu. ft. *Rem.*

(18.) 250 A. 16 pch. 0 sq. yd.
121 " 3 " 9 "
129 A. 12 pch. 21¼ sq. yd. *Ans.*

MULTIPLICATION OF COMPOUND NUMBERS.

PAGE 159.

Answers.

(1.) 5 T. 19 cwt. 13 lb.

(2.) 4202 mo. 10 d. 22 hr. 39 m. 52 sec.
Or 350 yr. 2 mo. 1 wk. 3 d. 22 hr. 39 m. 52 sec.

(3.) 39 mi. 5 fur. 4 rd. 2 yd.

(4.) 262 £ 12 s. 8 d.

(11.) 29 gal. 3 qt. 1 pt.
10
298 gal. 3 qt. = 298¾ gal.
298¾ × $1.23 = $367.46¼.

DIVISION OF COMPOUND NUMBERS.

PAGE 160.

Answers.

(3.) 4 T. 13 cwt. 1 qr. 20 lbs.

(4.) 9 mi. 6 fur. 30 rd. 1 ft.

(5.) 12 £ 9 s. 6 d. 3 far.

(6.) 9 cwt. 3 qr. 21 lb.

PRACTICAL PROBLEMS.

PAGE 161.

(1.) 16 A. 17 P.
9 " 57 "
5 " 25 "
11 " 102 "
42 A. 41 P.

(2.) 163 A. 9 P.
172 " 10 "
335 A. 19 P. Gave away.

640 A. 0 P.
335 A. 19 P.
304 A. 141 P. *Ans.*

(3.) 15 × 127 mi. 120 rd. = 1910 mi. 200 rd.
2500 mi. − 1910 mi. 200 rd. = 589 mi. 120 rd.

(4.) 16)150 bu. 3 pk. 0 qt. 0 pt.
9 bu. 1 pk. 5 qt. 1 pt.

(5.) 4)5 £ 4 s. 8 d.
1 £ 6 s. 2 d.
6
7 £ 17 s.

LONGITUDE AND TIME.

PAGE 162.—*Oral Exercise.*

7. If his watch is slow he has travelled east, and since it is 1 hour slow, he has travelled 15 degrees.

8. If his watch differs 1½ hours from local time he has travelled 1½ times 15°, or 22½°, and since his watch is fast, he has travelled west.

9. The men's watches differ 2 hr. 15 min., or 2¼ hr.; hence one is 2¼ times 15 degrees or 33¾ degrees farther west than the other, and his watch being the faster, which marks 12 o'clock 15 min., he is the farther east of the two.

10. The difference is 110° in distance, or 110 times 4 minutes of time, which is 440 minutes, or 7 hours 20 minutes.

WRITTEN PROBLEMS.

(11.) 84° 26′ W.
75° 10′ W.
15)9° 16′ = Dif.
37 4
= 37 min. 4 sec.

(12.) 13° 23′ 53″ E.
75° 10′ 00″ W.
88° 33″ 53″ = Dif.

NOTE.—When both places are west or both east, to find the difference in time subtract; but when one is east and the other west, to find the difference in time, add the two numbers.

(13.)
$$\begin{array}{llll} 15) & 88^\circ & 33' & 53'' \\ \hline & 5 & 54 & 15\frac{8}{15} \end{array}$$
$= 5$ hr. 54 min. $15\frac{8}{15}$ sec.

(14.)
$$\begin{array}{llll} 12 \text{ hr.} & 0 \text{ min.} & 0 & \text{sec.} \\ 5 \text{ “} & 54 \text{ “} & 15\frac{8}{15} & \text{“} \\ \hline 6 \text{ hr.} & 5 \text{ min.} & 44\frac{7}{15} & \text{sec. A. M.} \end{array}$$

(15.)
$$\begin{array}{lllll} & 122^\circ & 26' & 15'' & \text{W.} \\ & 13^\circ & 23' & 53'' & \text{E.} \\ \hline 15) & 135^\circ & 50' & 8'' & \text{Sum.} \\ \hline & 9 & 3 & 20\frac{8}{15} & \end{array}$$
$= 9$ hr. 3 min. $20\frac{8}{15}$ sec. = Difference in time.

Since Berlin has the faster time, it is 9 hr. 3 min. $20\frac{8}{15}$ sec. P. M.

(16.)
$$\begin{array}{lllll} & 122^\circ & 26' & 15'' & \text{W.} \\ & 75^\circ & 10' & 00'' & \text{W.} \\ \hline 15) & 47^\circ & 16' & 15'' & = \text{Dif.} \\ \hline & 3 & 9 & 5 & \end{array}
\qquad
\begin{array}{lll} 12 \text{ hr.} & 0 \text{ min.} & 0 \text{ sec. M.} \\ 3 \text{ “} & 9 \text{ “} & 5 \text{ “} \\ \hline 8 \text{ hr.} & 50 \text{ min.} & 55 \text{ sec. A. M.} \end{array}$$

(17.)
$$\begin{array}{lll} 2 \text{ hr.} & 3 \text{ min.} & 5 \text{ sec.} \\ & & 15 \text{ “} \\ \hline 30 & 46 & 15 \\ =30^\circ & 46' & 15'' \end{array}$$

(18.)
$$\begin{array}{ll} 1 \text{ hr.} & 10 \text{ min., fast.} \\ & 15 \\ \hline 17 & 30 = 17^\circ\ 30' \text{ W.} \\ \hline 2 \text{ hr.} & 6 \text{ min., slow.} \\ & 15 \\ \hline 31 & 30 = 31^\circ\ 30' \text{ E.} \end{array}$$

(19.) 50 min. 30 sec.

$$\begin{array}{r}
50\ \text{min.}\ 30\ \text{sec.} \\
15 \\
\hline
12\quad 37\quad 30 = 12^\circ\ 37'\ 30'' \\
\hline
75^\circ\ 10'\ \ 0''\ \text{W.} \\
12^\circ\ 37'\ 30'' \\
\hline
62^\circ\ 32'\ 30''\ \text{W.}
\end{array}$$

(20.)

$$\begin{array}{r}
84^\circ\ 26'\ \text{W.} \\
75^\circ\ 10'\ \text{“} \\
\hline
15)\underline{9^\circ\ 16'} \\
37\ 4 = 37\ \text{min.}\ 4\ \text{sec.}
\end{array}$$

DENOMINATE FRACTIONS.

CASE I.—PAGE 164.

(1.) $\frac{3}{144} \times \frac{4}{1} \times 2$ pt. $= \frac{1}{6}$ pt.

(2.) $\frac{1}{12000} \times 2000$ lb. $= \frac{1}{6}$ lb.

(3.) $\frac{3}{896} \times 4 \times 8 \times 2$ pt. $= \frac{3}{14}$ pt.

(4.) $\frac{1}{60} \times 8 \times 40 \times \frac{11}{2}$ yd. $= 29\frac{1}{3}$ yd.

(5.) $\frac{1}{54450} \times 4 \times 40 \times \frac{121}{4} \times 9$ sq. ft. $= \frac{4}{5}$ sq. ft.

(6.) $\frac{5}{196} \times 7 \times 24$ hr. $= 4\frac{2}{7}$ hr.

(7.) $\frac{2}{15} \times 4 \times 8$ qt. $= 4\frac{4}{15}$ qt.

(8.) $\frac{7}{160} \times 2000$ lb. $= 87\frac{1}{2}$ lb.

(9.) $\frac{1}{640} \times 20 \times 24$ gr. $= \frac{3}{4}$ gr.

CASE II.—PAGE 165.

(1.) $\frac{3}{5} \times 160$ rd. $= 96$ rd.

(2.) $\frac{3}{5} \times 4$ qt. $= \frac{12}{5}$ qt. $= 2\frac{2}{5}$ qt.
$\frac{2}{5} \times 2$ pt. $= \frac{4}{5}$ pt.

(3.) $\frac{1}{6} \times 20$ cwt. $= 3\frac{2}{6}$ cwt.
$\frac{2}{6} \times 4$ qr. $= 1\frac{1}{3}$ qr.
$\frac{1}{3} \times 25$ lb. $= 8\frac{1}{3}$ lb.
$\frac{1}{3} \times 16$ oz. $= 5\frac{1}{3}$ oz.

(4.) $\frac{1}{5} \times 12$ oz. $= 2\frac{2}{5}$ oz.
$\frac{2}{5} \times 20$ dwt. $= 8$ dwt.

(5.) $\frac{5}{6} \times 4$ pk. $= 3\frac{1}{3}$ pk.
$\frac{1}{3} \times 8$ qt. $= 2\frac{2}{3}$ qt.
$\frac{2}{3} \times 2$ pt. $= 1\frac{1}{3}$ pt.

(6.) $\frac{1}{3} \times 8$ cd. ft. $= 2\frac{2}{3}$ cd. ft.
$\frac{2}{3} \times 16$ cu. ft. $= 10\frac{2}{3}$ cu. ft.
$\frac{2}{3} \times 1728$ cu. in. $= 1152$ cu. in.

(7.) $\frac{7}{9} \times 8$ fur. $= 6\frac{2}{9}$ fur.
$\frac{2}{9} \times 40$ rd. $= 8\frac{8}{9}$ rd.
$\frac{8}{9} \times \frac{11}{2}$ yd. $= 4\frac{8}{9}$ yd.
$\frac{8}{9} \times 3$ ft. $= 2\frac{2}{3}$ ft.
$\frac{2}{3} \times 12$ in. $= 8$ in.

CASE III.

(1.)
$$\begin{array}{rl} .9375 & \\ \underline{4} & \text{qt.} \\ 3).7500 & \\ \underline{2} & \text{pt.} \\ 1).5000 & \\ \underline{4} & \\ 2) & \end{array}$$

(2.)
$$\begin{array}{rl} .965625 & \\ \underline{8} & \text{fur.} \\ 7).725 & \\ \underline{40} & \text{rd.} \\ 29.000 & \end{array}$$

(3.)
$$\begin{array}{rl} .323 & \\ \underline{20} & \text{cwt.} \\ 6).46 & \\ \underline{4} & \text{qr.} \\ 1).84 & \\ \underline{25} & \text{lb.} \\ 21. & \end{array}$$

(4.)
$$\begin{array}{rl} .8 & \\ \underline{4} & \text{pk.} \\ 3).2 & \\ \underline{8} & \text{qt.} \\ 1).6 & \\ \underline{2} & \text{pt.} \\ 1.2 & \end{array}$$

(5.)
$$\begin{array}{rl} .875 & \\ \underline{5\frac{1}{2}} & \text{yd.} \\ 4).8125 & \\ \underline{3} & \text{ft.} \\ 2).4375 & \\ \underline{12} & \text{in.} \\ 5.25 & \end{array}$$

(6.)
$$\begin{array}{rl} .976 & \\ \underline{160} & \text{sq. rd.} \\ 156).16 & \\ \underline{30\frac{1}{4}} & \text{sq. yd.} \\ 4).84 & \\ \underline{9} & \text{sq. ft.} \\ 7).56 & \\ \underline{144} & \text{sq. in.} \\ 80.64 & \end{array}$$

CASE IV.—PAGE 166.

(1.) $\frac{3}{4} \times \frac{1}{4} \times \frac{1}{12} \times \frac{1}{20}$ £ $= \frac{1}{1280}$ £.

(2.) $\frac{3}{14} \times \frac{1}{2} \times \frac{1}{8} \times \frac{1}{4}$ bu. $= \frac{3}{896}$ bu.

(3.) $\frac{5}{8} \times \frac{1}{16} \times \frac{1}{16}$ lb. $= \frac{5}{2048}$ lb.

(4.) $\frac{3}{9} \times \frac{1}{4} \times \frac{1}{2} \times \frac{1}{4}$ gal. $= \frac{1}{96}$ gal.

(5.) $\frac{3}{4} \times \frac{1}{25} \times \frac{1}{4} \times \frac{1}{20}$ T. $= \frac{3}{8000}$ T.

(6.) $\frac{625}{1000} \times \frac{1}{25} \times \frac{1}{4} \times \frac{1}{20}$ T. $= \frac{1}{3200}$ T.

(7.) $\frac{316}{100} \times \frac{1}{4} \times \frac{1}{2} \times \frac{1}{4}$ gal. $= \frac{79}{800}$ gal.

CASE V.

(1.) 1 lb. = 256 dr.
10 oz. 6 dr. = 166 dr. = $\frac{166}{256}$ lb.

(2.) 1 bu. = 64 pt.
3 pk. 4 qt. 1 pt. = 57 pt. = $\frac{57}{64}$ bu.

(3.) 1 T. = 2000 lb.
9 cwt. 1 qr. 6 lb. = 931 lb. = $\frac{931}{2000}$ T.

(4.) 1 bbl. = 252 pt.
9 gal. 3 qt. 1 pt. = 79 pt. = $\frac{79}{252}$ bbl.

(5.) 1 mi. = 1760 yd.
3 fur. 10 rd. 2 yd. = 717 yd. = $\frac{717}{1760}$ mi.

(6.) 5 bu. = 320 pt.
3 bu. 2 pk. 1 pt. = 225 pt. = $\frac{45}{64}$ of 5 bu.

CASE VI.—PAGE 167.

(1.) 2)1.0 pt.
8)6.5 qt.
.8125 pk.

(2.) 2)1. pt.
4)1.5 qt.
1.375 gal.

(3.) 40)90 rd.
8)2.25 fur.
.28125 mi.

(4.) 16)3 oz.
25)6.1875 lb.
4).2475 qr.
20)3.061875 cwt.
.15309375 T.

(5.) 2 bu. 1 pk. 2 qt. = 74 qt.
6 bu. 3 pk. 4 qt. = 220 qt.
74 ÷ 220 = .33636 +.

(6.) 10 lb. 1 oz. 8 dr. = 2584 dr.
19 lb. 3 oz. 10 dr. = 4922 dr.
2584 ÷ 4922 = .52499 –.

(7.) 2 lb. 2 oz. Troy = 12480 gr.
2 lb. 2 oz. Avoir. = 14875 gr.
12480 ÷ 14875 = .83899 +.

(8.) 6 sq. ft. = 6 sq. ft.
6 ft. sq. = 36 sq. ft.
6 ÷ 36 = .166 +.

PRACTICAL EXAMPLES, PAGE 168.

(1.) 25)5.
4)3.2 qr.
20)2.8 cwt.
1.14 × $22 = $25.08.

(2) 5)200 £ 10 s. 6 d.
40 £ 2 s. $1\frac{1}{5}$ d.
12
481 £ 5 s. $2\frac{2}{5}$ d.

(3.) 70 bu. 3 pk.
3
212 bu. 1 pk. = $212\frac{1}{4}$ bu.
$212\frac{1}{4}$ × $1.50 = 318.37\frac{1}{2}$.

(4.) 100)10
20)3.1 cwt.
19.155 × $5.75 = $110.14 +.

(5.) 32 gal. 2 qt. 1 pt.
6
195 gal. 3 qt. = $195\frac{3}{4}$ gal.
$195\frac{3}{4}$ × $2.10 = $411.075.

(6.) 1263 bu. 3 pk.
116 " 2 "
1147 bu. 1 pk. = 1147.25 pk.
1147.25 × $1.30 = $1491.425.

(7.) 12)730 lb. 8 oz.
60 lb. 14 oz.
10
608 lb. 12 oz.

(8.) 4)310 A. 16 P.
77 A. 84 P., Amt. sold.
310 A. 16 P.
77 A. 84 P.
4)232 A. 92 P.
58 A. 23 P., each son.

(9.) 18 lb. 6 oz. = 18.375 lbs.
18.375 × 25¢ = $4.59375
$4.59375 ÷ 12¢ = 38.28125.

(10.) 25)10
4)3.4 qr.
20)2.85 cwt.
106.1425 × $30 = $3184.275.

(11.) 16)10
20.625 × $8.25 = $170.156+.

(12.) 16.723 × 64 pt. = 1070.272 pt.
1070.272 × $1\frac{1}{2}$¢ = $16.05 +.

(13.) 160 A. 32 P.
112 A. 10 P.
48 A. 22 P.
112 A. 10 P. = 112.0625 A.
112.0625 × $112 = $12551.
48 A. 22 P. = 48.1375 A.
48.1375 × $120 = $5776.50.
$12551 + $5776.50 = $18327.50.

(14.) 3 T. 12 cwt. 10 lb. = 3.605 T.
17.304 ÷ 3.605 = 4.80, Val. per ton.
10.15 × $4.80 = $48.72.

(15.) 52 × 1200 = 62400 copies per year.
62400 ÷ 480 = 130. *Ans.*

(16.) 312 ÷ 24 = 13, No. sheets.
1000 × 13 sh. = 13000 sheets.
13000 sheets = 27 R. 1 qr. 16 sh.

(17.) 216 × $\frac{1}{4}$ oz. = 54 oz. = 3$\frac{3}{8}$ lb.
3$\frac{3}{8}$ × 15¢ = $.506 +.

(18.) 2)1.
8).5 qt.
4)3.0625 pk.
6.765625 × $2 = $13.53125.
$13.53125 ÷ $.13 = 104.086 +. *Ans.*

(19.) 1 T. 3 cwt. 20 lb. = 1.16 T.
1.45 T.
18 cwt. 6 lb. = .903 T.
3.513 T.
3.513 × $25 = $87.825. *Ans.*

(20.) 62.75 bu.

3672 lb. = 61.20 “

68 bu. 3 pk. = 68.75 “

73 bu. 18 lb. = 73.3 “

$52\frac{6}{15}$ bu. = 52.4 “

318.40 × \$1.25 = \$398. *Ans.*

RATIO.

PAGE 170.—*Oral Exercise.*

1. The relation of 12 to 6 is $\frac{12}{6}$, or 2.

2. The relation of \$15 to \$5 is $\frac{15}{5}$, or 3.

3. The ratio of 64 to 8 is $\frac{64}{8}$, or 8.

8. There is no ratio between \$9 and 3 books, since \$9 is not divisible by 3 books.

Written Problems.

(4.) 326 bu. 2 pk. ÷ 40 bu. 3 pk. 2 qt. = 8.

(5.) 191 lb. 10 oz. ÷ 27 lb. 6 oz. = 7.

(6.) 3 yd. 2 ft. 5 in. ÷ 30 yd. 1 ft. 4 in. = $\frac{1}{8}$.

(10.) $6\frac{1}{2} \times \frac{3}{4} \div 4\frac{1}{3} \times 1\frac{1}{5} = \frac{13}{2} \times \frac{3}{4} \times \frac{3}{13} \times \frac{5}{6} = \frac{15}{16}$.

(14.) $$\frac{3\frac{1}{2}}{6\frac{1}{4}} \div \frac{12\frac{1}{4}}{3\frac{1}{6}} = \frac{3\frac{1}{2}}{6\frac{1}{4}} \times \frac{3\frac{1}{6}}{12\frac{1}{4}} = \frac{7}{2} \times \frac{4}{25} \times \frac{19}{6} \times \frac{4}{49} = \frac{76}{525}.$$

(15.) $$\frac{1}{6}\text{of}\frac{7\frac{1}{4}}{\frac{1}{2}\text{ of }\frac{1}{6}} \div \frac{1}{4}\text{of}\frac{16\frac{1}{5}}{\frac{3}{4}\text{ of } 6} = \frac{\frac{1}{6} \times \frac{29}{4}}{\frac{1}{2} \times \frac{1}{6}} \div \frac{\frac{1}{4} \times \frac{81}{5}}{\frac{3}{4} \times \frac{6}{1}} = \frac{\frac{1}{6} \times \frac{29}{4}}{\frac{1}{2} \times \frac{1}{6}} \times$$
$$\frac{\frac{3}{4} \times \frac{6}{1}}{\frac{1}{4} \times \frac{81}{5}} = \frac{1}{6} \times \frac{29}{4} \times \frac{2}{1} \times \frac{6}{1} \times \frac{3}{4} \times \frac{6}{1} \times \frac{4}{1} \times \frac{5}{81} = \frac{145}{9} = 16\frac{1}{9}.$$

Ans.

PROPORTION.

PAGE 172.

Answers.

(1.) $x = 18$.

(2.) $x = 8\frac{4}{7}$.

(3.) $x = 4\frac{4}{5}$.

(4.) $x = \$3\frac{1}{8}$.

(5.) $x = 16\frac{4}{5}$.

(6.) $x = 17\frac{1}{2}$.

(7.) $x = 6\frac{2}{3}$.

(8.) $x = 5.4$.

(9.) $x = \frac{5}{9}$.

(10.) $x = 47\frac{1}{2}$ gal.

(11.) $x = \$23\frac{9}{17}$.

(12.) $x = \$4$.

(13.) $x = \$3\frac{3}{20}$.

(14.) $x = \$1\frac{3}{7}$.

(15.) $x = 2\frac{7}{10}$.

Oral Exercises.

2. If 3 oranges cost 10 cents, 15 oranges will cost as many times 10 cents as the ratio of 15 to 3, or 5 times 10 cents, which is 50 cents.

3. If 6 boys can earn 10 dollars in a day, 9 boys can earn as many times 10 dollars as the ratio of 9 to 6, or $\frac{3}{2}$ of 10 dollars, which is 15 dollars.

4. If 5 barrels of sugar cost $120, 2 barrels will cost as many times $120 as the ratio of 2 to 5, or $\frac{2}{5}$ of $120, which is $48.

9. If 3 bushels of apples cost 90 cents, 25 bushels will cost as many times 90 cents as the ratio of 25 to 3, or $\frac{25}{3}$ of 90 cents, which is $7.50.

10. If 90 cents buy 3 bushels of apples, $4.50 will buy as many times 3 bushels as the ratio of $4.50 to 90 cents, or 5 times 3 bushels, which is 15 bushels.

13. If a tree 20 feet high cast a shadow 50 feet, a tree 50 feet high will cast a shadow as many times 50 feet as the ratio of 50 to 20, or $\frac{5}{2}$ of 50 feet, which is 125 feet.

14. If a tree 18 feet high cast a shadow 45 feet, to cast a shadow 135 feet will require a tree as many times 18

feet high as the ratio of 135 to 45, or 3 times 18 feet, which is 54 feet.

15. If a family of 6 pay \$21 a week for board, a family of 8 will pay as many times \$21 as the ratio of 8 to 6, or $\frac{4}{3}$ of \$21, which is \$28.

PAGE 174.—*Written Problems.*

(3.) 6 hor. : 10 hor. : : \$1250 : x. $\dfrac{10 \times \$1250}{6} = \$2083\frac{1}{3}$.

(7.) 19 : 25 : : \$7.03 : x. $\dfrac{25 \times \$7.03}{19} = \$9.25$.

(11.) $14\frac{1}{2}$: 21 : : $6\frac{1}{2}$ cd. : x. $\dfrac{21 \times 6\frac{1}{2}\text{ cd.}}{14\frac{1}{2}} = 9\frac{12}{29}$ cd.

(13.) 600 : 1450 : : \$53.25 : x. $\dfrac{1450 \times \$53.25}{600} = \$128.69 -$.

(14.) 3 : 7 : : $6\frac{1}{2}$ T. : x. $\dfrac{7 \times 6\frac{1}{2}\text{ T.}}{3} = 15\frac{1}{6}$ T.

(15.) 8 : 5 : : 220 mi. : x. $\dfrac{5 \times 220\text{ mi.}}{8} = 137\frac{1}{2}$ mi.

(16.) 220 : 446 : : 8 hr. : x. $\dfrac{446 \times 8\text{ hr.}}{220} = 16\frac{12}{55}$ hr.

(17.) 9 hr. 40 min. $= 9\frac{2}{3}$ hr.
300 : 223 : : $9\frac{2}{3}$ hr. : x. $\dfrac{223 \times 9\frac{2}{3}\text{ hr.}}{300} = 7\frac{167}{900}$ hr.
= 7hr. 11 min. 8 sec.

(18.) 9 hr. 15 min. : 5 hr. 20 min. : : 223 mi. : x.
$9\frac{1}{4}$ hr. : $5\frac{1}{3}$ hr. : : 223 mi. : x.
$\dfrac{5\frac{1}{3} \times 223\text{ mi.}}{9\frac{1}{4}} = 128\frac{64}{111}$ mi.

(19.) 20×4 T. 3 cwt. = 83 T.

$$6\text{ T.} : 83\text{ T.} :: \$28.50 : x. \quad \frac{83 \times \$28.50}{6} = \$394.25.$$

(20.) 12×4 T. 13 cwt. = 55 T. 16 cwt. = 55.8 T.

4 T. 4 cwt. = 4.2 T.

4.2 T. : 55.8 T. : : \$22.05 : x.

$$\frac{55.8 \times \$22.05}{4.2} = \$292.95.$$

(21.) 12 A. 30 P. : 16 A. 10 P. : : 255 bu. 2 qt. : x.

$12\frac{3}{16}$ A. : $16\frac{1}{16}$ A. : : $255\frac{1}{16}$ bu. : x.

$$\frac{16\frac{1}{16} \times 255\frac{1}{16}\text{ bu.}}{12\frac{3}{16}} = 336.159 + \text{bu.}$$

(22.) $$180 : 500 :: 24\text{ lb.} : x. \quad \frac{500 \times 24\text{ lb.}}{180} = 66\tfrac{2}{3}\text{ lb.}$$

(23.) $$48 : 50 :: 360\text{ qt.} : x. \quad \frac{50 \times 360\text{ qt.}}{48} = 375\text{ qt.}$$

(24.) $$11 : 16 :: 20\text{ d.} : x. \quad \frac{16 \times 20\text{ d.}}{11} = 29\tfrac{1}{11}\text{ d.}$$

(25.) $$24 : 30 :: 12\text{ men} : x. \quad \frac{30 \times 12\text{ men}}{24} = 15\text{ men.}$$

(26.) \$1.00 : \$.33 : : \$6742.50 : x.

$$\frac{.33 \times \$6742.50}{\$1.00} = \$2225.02\tfrac{1}{2}.$$

PAGE 176.

(27.) $$6.80 : 8.50 :: 12\text{ oz.} : x. \quad \frac{8.50 \times 12\text{ oz.}}{6.80} = 15\text{ oz.}$$

(28.) $$\tfrac{5}{9} : \tfrac{7}{8} :: \$5200 : x. \quad \frac{\frac{7}{8} \times \$5200}{\frac{5}{9}} = \$8190.$$

(29.) $246 : 82 :: 12\frac{1}{2}\text{ T.} : x.\quad \dfrac{82 \times 12\frac{1}{2}\text{ T.}}{246} = 4\frac{1}{6}\text{ T.}$

(30.) $50 : 70 :: 27\text{ ft.} : x.\quad \dfrac{70 \times 27\text{ ft.}}{50} = 37\frac{4}{5}\text{ ft.}$

(31.) $18 : 39 :: 25\text{ ft.} : x.\quad \dfrac{39 \times 25\text{ ft.}}{18} = 54\frac{1}{6}\text{ ft.} = 54\text{ ft. }2\text{ in.}$

(32.) $180 : 260 :: 20\text{ bbl.} : x.\quad \dfrac{260 \times 20\text{ bbl.}}{180} = 28\frac{8}{9}\text{ bbl.}$

(33.) $\frac{7}{8} : \frac{3}{4} :: 36\text{ yd.} : x.\quad \dfrac{\frac{3}{4} \times 36\text{ yd.}}{\frac{7}{8}} = 30\frac{6}{7}\text{ yd.}$

(34.) $25 : 22 :: 12\text{ hr. }15\text{ min.} : x.$

$$\frac{22 \times 12\text{ hr. }15\text{ min.}}{25} = 10\text{ hr. }46\text{ min. }48\text{ sec.}$$

(35.) $7 : 9 :: \$16000 : x.\quad \dfrac{9 \times \$16000}{7} = \$20571.43.$

(36.) $1.20 : 1.40 :: 75¢ : x.\quad \dfrac{1.40 \times 75¢}{1.20} = 87\frac{1}{2}¢.$

(37.) $\frac{1}{2} \times \frac{3}{4} \times 6\frac{1}{2} : \frac{7}{8} \times \frac{5}{6} \times 3\frac{1}{5} :: \$78 : x.$

$$\frac{\frac{7}{8} \times \frac{5}{6} \times 3\frac{1}{5} \times \$78}{\frac{1}{2} \times \frac{3}{4} \times 6\frac{1}{2}} = \frac{7}{8} \times \frac{5}{6} \times \frac{16}{5} \times \$78 \times \frac{2}{1} \times \frac{4}{3} \times \frac{2}{13} = \$74.66\frac{2}{3}.$$

(38.) $175 \times 8¢ = \$14;\ 1\text{ qt.} = 8\text{ gills.}$

$8 : 7\frac{3}{4} :: \$14 : x.$

$$\frac{7\frac{3}{4} \times \$14}{8} = \$13.56\frac{1}{4}.$$

(39.) $6850 : 1540 :: \$4932 : x.\quad \dfrac{1540 \times \$4932}{6850} = \$1108.80.$

COMPOUND PROPORTION.

(1.) $$\left.\begin{array}{r} 16\text{ m.} : 22\text{ m.} \\ 8\text{ d.} : 12\text{ d.} \end{array}\right\} :: \$256 : x. \quad \frac{22\times12\times\$256}{16\times8}=\$528.$$

(2.) $$\left.\begin{array}{r} 3\text{ m.} : 5\text{ m.} \\ 10\text{ d.} : 12\text{ d.} \\ 8\text{ hr.} : 10\text{ hr.} \end{array}\right\} :: \$96 : x. \quad \frac{5\times12\times10\times\$96}{3\times10\times8}=\$240.$$

(3.) $$\left.\begin{array}{r} 8\text{ ft.} : 5\text{ ft.} \\ 60\text{ in.} : 20\text{ in.} \\ 6\text{ in.} : 7\text{ in.} \end{array}\right\} :: 1400\text{ lb.} : x.$$

$$\frac{5\times20\times7\times1400\text{ lb.}}{8\times60\times6}=340\tfrac{5}{18}\text{ lb.}$$

(4.) $$\left.\begin{array}{r} 3\text{ m.} : 6\text{ m.} \\ 60\text{ ft.} : 100\text{ ft.} \\ 8\text{ ft.} : 6\text{ ft.} \end{array}\right\} :: 10\text{ d.} : x.$$

$$\frac{6\times100\times6\times10\text{ d.}}{3\times60\times8}=25\text{ d.}$$

(5.) $$\left.\begin{array}{r} 2\text{ h.} : 6\text{ h.} \\ 4\text{ d.} : 12\text{ d.} \end{array}\right\} :: 3\text{ bu.} : x. \quad \frac{6\times12\times3\text{ bu.}}{2\times4}=27\text{ bu.}$$

(6.) $$\left.\begin{array}{r} 6\text{ p.} : 8\text{ p.} \\ 20\text{ d.} : 30\text{ d.} \end{array}\right\} :: 1\text{ bbl.} : x. \quad \frac{8\times30\times1\text{ bbl.}}{6\times20}=2\text{ bbl.}$$

(7.) $$\left.\begin{array}{r} 6\text{ wk.} : 3\text{ wk.} \\ 5\text{ p.} : 7\text{ p.} \end{array}\right\} :: \$135 : x. \quad \frac{3\times7\times\$135}{6\times5}=\$94.50.$$

(8.) $$\left.\begin{array}{r} \$500 : \$800 \\ 2\text{ yr.} : 3\text{ yr.} \\ 6\% : 8\% \end{array}\right\} :: \$60 : x. \quad \frac{800\times3\times8\times\$60}{500\times2\times6}=\$192.$$

(9.) $$\left.\begin{array}{r} \$700 : \$600 \\ \$96 : \$105 \\ 5\% : 8\% \end{array}\right\} :: 2\text{ yr.} : x.$$

$$\frac{600\times105\times8\times2\text{ yr.}}{700\times96\times5}=3\text{ yr.}$$

(10.) $$\left.\begin{array}{l} 6\text{ d.} : 3\text{ d.} \\ 10\text{ hr.} : 12\text{ hr.} \\ 80\text{ rd.} : 60\text{ rd.} \\ 40\text{ rd.} : 60\text{ rd.} \end{array}\right\} :: 6\text{ d.} : x.$$

$$\frac{3\times12\times60\times60\times6\text{ d.}}{6\times10\times80\times40}=4\tfrac{1}{20}\text{ d.}=4\text{ hr. }30\text{ min.}$$

$\frac{1}{20}$ of 10 hr. = 30 min.

(11.) $$\left.\begin{array}{l} 10\text{¢} : 6\text{¢} \\ \$6 : \$8 \end{array}\right\} :: 15\text{ oz.} : x. \quad \frac{6\times8\times15\text{ oz.}}{10\times6}=12\text{ oz.}$$

(12.) $$\left.\begin{array}{l} 8\tfrac{1}{2}\text{ in.} : 8\text{ in.} \\ 4\tfrac{1}{8}\text{ in.} : 4\text{ in.} \\ 2\tfrac{3}{8}\text{ in.} : 2\tfrac{3}{8}\text{ in.} \end{array}\right\} :: 90000 : x.$$

$$\frac{8\times4\times2\tfrac{3}{8}\times90000}{8\tfrac{1}{2}\times4\tfrac{1}{8}\times2\tfrac{3}{8}}=82139+.$$

(13.) $$\left.\begin{array}{l} 10\text{ com.} : 6\text{ com.} \\ 12\text{ hr.} : 10\text{ hr.} \\ 24\text{ sh.} : 20\text{ sh.} \\ 24\text{ pp.} : 16\text{ pp.} \\ 40\text{ li.} : 50\text{ li.} \\ 40\text{ let.} : 48\text{ let.} \end{array}\right\} :: 12\text{ d.} : x.$$

$$\frac{6\times10\times20\times16\times50\times48\times12\text{ d.}}{10\times12\times24\times24\times40\times40}=5\text{ d.}$$

(14.) $$\left.\begin{array}{l} 9\text{ p.} : 8\text{ p.} \\ 4\text{ mo.} : 3\text{ mo.} \\ \$6 : \$8 \end{array}\right\} :: \$24 : x. \quad \frac{8\times3\times8\times\$24}{9\times4\times6}=\$21\tfrac{1}{3}.$$

(15.) $$\left.\begin{array}{l} 25\text{ p.} : 42\text{ p.} \\ 6\text{ c.} : 12\text{ c.} \\ 3\text{ h.} : 25\text{ h.} \end{array}\right\} :: 30\text{ sh.} : x.$$

$$\frac{42\times12\times25\times30\text{ sh.}}{25\times6\times3}=840\text{ sh.}$$

(16.) $\left.\begin{array}{r}\frac{3}{4}\text{ yd.} : 1\text{ yd.}\\ \$1.20 : \$1.75\end{array}\right\} : : \$45 : x.\quad \frac{1\times1.75\times\$45}{\frac{3}{4}\times1.20}=\$87.50.$

(17.) $\left.\begin{array}{r}18\text{ ft.} : 15\text{ ft.}\\ 15\text{ ft.} : 9\text{ ft.}\end{array}\right\} : : \$36 : x.\quad \frac{15\times9\times\$36}{18\times15}=\$18.$

(18.) $\left.\begin{array}{r}3000\text{ lb.} : 6550\text{ lb.}\\ 40\text{ ¢} : 35\text{ ¢}\end{array}\right\} : : \$120 : x.$

$$\frac{6550\times35\times\$120}{3000\times40}=\$229.25.$$

(19.) $\left.\begin{array}{r}40\text{ ft.} : 30\text{ ft.}\\ 30\text{ ft.} : 30\text{ ft.}\\ 6\text{ ft.} : 5\frac{1}{2}\text{ ft.}\end{array}\right\} : : \$150 : x.$

$$\frac{30\times30\times5\frac{1}{2}\times\$150}{40\times30\times6}=\$103.12\frac{1}{2}.$$

(20.) $105\text{ bu.} : 90\text{ bu.} : : 14\text{ d.} : x.$

$$\frac{90\times14\text{ d.}}{105}=12\text{ d.}$$

$$\left.\begin{array}{r}24\text{ h.} : 20\text{ h.}\\ 105\text{ bu.} : 90\text{ bu.}\end{array}\right\} : : 14\text{ d.} : x.$$

$$\frac{20\times90\times14\text{ d.}}{24\times105}=10\text{ d.}$$

$$12\text{ d.}+10\text{ d.}=22\text{ d.}$$

Explanation.—If 20 horses consume the oats in 14 days, it will require 1 horse 20 times as long; 20 is therefore a multiplier or member of the second term, and 24 is the corresponding divisor.

If it require 14 days to consume 105 bushels of oats, to consume 1 bushel will require $\frac{1}{105}$ as long; 105 is therefore a divisor, and $\frac{1}{2}$ of 180, or 90, is the corresponding multiplier; hence, to consume 90 bushels will require 24 horses $\frac{20\times90\times14\text{ days}}{24\times105}$, or 10 days, which added to 12 days, the time required for 20 horses to consume $\frac{1}{2}$ of 180 bushels, is 22 days.

(21.)

$$\left.\begin{array}{rcl} 20\text{ m.} &:& 16\text{ m.}\\ 40\text{ rd.} &:& 45\text{ rd.}\\ 3\text{ ft.} &:& 3\tfrac{1}{2}\text{ ft.}\\ 2\tfrac{1}{2}\text{ ft.} &:& 3\text{ ft.}\\ 10\text{ hr.} &:& 12\text{ hr.}\end{array}\right\} :: 10\text{ d.} : x.$$

$$\frac{16\times45\times3\tfrac{1}{2}\times3\times12\times10\text{ d.}}{20\times40\times3\times2\tfrac{1}{2}\times10} = 15\tfrac{3}{25}\text{ d.}$$

$$\left.\begin{array}{rcl} 12\text{ m.} &:& 16\text{ m.}\\ 40\text{ rd.} &:& 15\text{ rd.}\\ 3\text{ ft.} &:& 3\tfrac{1}{2}\text{ ft.}\\ 2\tfrac{1}{2}\text{ ft.} &:& 3\text{ ft.}\\ 10\text{ hr.} &:& 12\text{ hr.}\end{array}\right\} :: 10\text{ d.} : x.$$

$$\frac{16\times15\times3\tfrac{1}{2}\times3\times12\times10\text{ d.}}{12\times40\times3\times2\tfrac{1}{2}\times10} = 8\tfrac{2}{5}\text{ d.}$$

$$15\tfrac{3}{25}\text{ d.} + 8\tfrac{2}{5}\text{ d.} = 23\tfrac{13}{25}\text{ d.}$$

$$\tfrac{13}{25}\times10\text{ hr.} = \tfrac{130}{25}\text{ hr.} = 5\text{ hr. }12\text{ min.}$$

Explanation.—If 16 men dig a ditch in a certain time, it will require 1 man 16 times as long; hence, 16 is a multiplier, and the corresponding number of men, 20, is the corresponding divisor.

If it require a certain time to dig 40 rods, to dig 1 rod will require $\frac{1}{40}$ as long; hence, 40 is a divisor, and $\frac{3}{4}$ of 60, or 45, is the corresponding multiplier.

If it require a certain time to dig a ditch 3 feet wide, to dig it 1 foot wide will require $\frac{1}{3}$ as long; hence, 3 is a divisor, with $3\frac{1}{2}$ as its corresponding multiplier.

If it require a certain time to dig a ditch $2\frac{1}{2}$ feet wide, to dig a ditch 1 foot wide will require a shorter time; therefore, $2\frac{1}{2}$ is a divisor, with 3 as its corresponding multiplier.

If it require a certain time to dig a ditch by working 12 hours a day, by working 1 hour a day it will require 12 times as long; 12 is therefore a multiplier, with 10 as the corresponding divisor. Hence, to dig 45 rods will require 20 men

$$\frac{16\times45\times3\tfrac{1}{2}\times3\times12\times10\text{ days}}{20\times40\times3\times2\tfrac{1}{2}\times10},\text{ or }15\tfrac{3}{25}\text{ days.}$$

The second portion of the solution is explained in a similar manner.

DISTRIBUTIVE PROPORTION.

PAGE 180.—*Oral Exercise.*

3. The pasturage of 4 cows for 6 weeks is the same as the pasturage of 1 cow for 24 weeks. The pasturage of 2 cows for 15 weeks is the same as the pasturage of 1 cow for 30 weeks. 108 dollars is therefore the cost of the pasturage for 24 weeks plus 30 weeks, or 54 weeks. The pasturage for 1 week costs $\frac{1}{54}$ of \$108, or \$2. A therefore pays 24 times \$2, or \$48, and B 30 times \$2, or \$60.

5. The feed of 10 sheep for 3 weeks costs as much as the feed of 30 sheep for 1 week. If the feed of 1 cow equals the feed of 5 sheep, the feed of 4 cows costs as much as the feed of 20 sheep; hence, the feed of 4 cows for 2 weeks costs as much as the feed of 20 sheep for 2 weeks or 40 sheep for 1 week. The feed of 1 horse equals the feed of 2 cows, or 2 times 5 sheep, which is 10 sheep; hence, the feed of 6 horses for 3 weeks costs as much as the feed of 6 times 10 sheep, or 60 sheep, for 3 weeks, or 180 sheep for 1 week. The feed of all equals the feed of 30 sheep, 40 sheep, and 180 sheep, or 250 sheep. If the feed of 250 sheep costs \$60, the feed of 1 sheep for 1 wk. costs $\frac{1}{250}$ of \$60, or 24 cents, and the feed of a cow, which eats 5 times as much a sheep, 5 times 24 cents, or \$1.20, and the feed of a horse 2 times \$1.20, or \$2.40.

PAGE 181.

9. *Sug.* If the numbers are to one another as $\frac{1}{2}$, $\frac{1}{3}$, and $\frac{5}{12}$, they are to one another as $\frac{6}{12}$, $\frac{4}{12}$, and $\frac{5}{12}$, or as 6, 4, and 5.

10. *Sug.* If the money is to be divided in the proportion of $1\frac{1}{2}$, $\frac{3}{4}$, and $1\frac{3}{4}$, it is to be divided in the proportion of $\frac{6}{4}$, $\frac{3}{4}$, and $\frac{7}{4}$, or in the proportion of 6, 3, and 7, making

16 equal parts. 6 of these parts, or \$600 = $\frac{1}{4}$ A's, 3 parts, or \$300 = $\frac{1}{5}$ B's, and 7 parts, or \$700 = $\frac{1}{6}$ C's.

13. *Sug.* B's money + \$2500 = A's, and this added to B's equals twice B's + \$2500, or both, which is \$7000; hence, \$7000 − \$2500, or \$4500, is twice B's, etc.

14. *Sug.* \$1.50 plus the cost of the vest equals the cost of the hat, and this added to the cost of the vest equals twice the cost plus \$1.50, which equals both, or \$11.50; hence \$11.50 − \$1.50, or \$10 = twice the cost of the vest.

15. *Sug.* Since the boots cost \$10 less than the coat, and the hat \$4 less than the boots, the hat cost \$14 less than the coat; hence the cost of the coat less \$10, and the cost of the coat less \$14, added to the cost of the coat equals 3 times the cost of the coat less \$24, which equals \$31. \$31 + \$24, or \$55 = 3 times the cost of the coat. The cost of the coat is therefore $\frac{1}{3}$ of \$55, or \$18$\frac{1}{3}$, the cost of the boots \$18$\frac{1}{3}$ − \$10, or \$8$\frac{1}{3}$, and the cost of the hat \$8$\frac{1}{3}$ − \$4, or \$4$\frac{1}{3}$.

18. *Sug.* D's age = $\frac{3}{5}$ C's age; hence $\frac{3}{5}$ C's + $\frac{5}{5}$ C's, or $\frac{8}{5}$ C's = 120 yrs. $\frac{1}{5}$ C's = $\frac{1}{8}$ of 120 yrs. = 15 yrs., $\frac{5}{5}$ or C's = 5 times 15 yrs., or 75 yrs., and $\frac{3}{5}$ C's, or D's = 3 times 15 yrs., or 45 yrs.

19. *Sol.* If B pays twice as much as A, and C pays 3 times as much as B, he pays 6 times as much as A. 6 times A's amount, or C's, plus twice A's amount, or B's, plus A's amount, equals 9 times A's amount, or what they together pay, which is \$18,000. A therefore pays $\frac{1}{9}$ of \$18,000, or \$2000; B pays 2 times \$2000, or \$4000, and C pays 6 times \$2000, or \$12,000.

PAGE 182.

20. The farm cost twice as much as the hotel; and since the store cost 3 times as much as the farm, plus \$4000, it

cost 6 times as much as the hotel, plus \$4000. The cost of all, therefore, was 1 time plus 2 times plus 6 times, or 9 times, the cost of the hotel, plus \$4000, which is \$40,000. 9 times the cost of the hotel is therefore \$40,000 less \$4000, or \$36,000; once the cost of the hotel is $\frac{1}{9}$ of \$36,000, which is \$4000. The farm cost twice \$4000, or \$8000, and the store 6 times \$4000, or \$24,000, plus \$4000, which is \$28,000.

21. If $\frac{3}{4}$ the price of a piano is $1\frac{1}{5}$ or $\frac{6}{5}$ the price of a cabinet organ, $\frac{1}{4}$ the price of the piano is $\frac{1}{3}$ of $\frac{6}{5}$, or $\frac{2}{5}$, the price of the organ, and the price of the piano is 4 times $\frac{2}{5}$, or $\frac{8}{5}$, the price of the organ, which, added to the price of the organ, is $\frac{13}{5}$ of the price of the organ, or the price of both, which is \$780. $\frac{1}{5}$ of the price of the organ is $\frac{1}{13}$ of \$780, which is \$60, and $\frac{5}{5}$ is 5 times \$60, or \$300. The price of the piano is \$780 − \$300, or \$480.

Written Problems.

(1.) $27 + 30 + 22 = 79$.
$\frac{1}{79} \times \$165.90 = \$2.10$.
$27 \times \$2.10 = \$56.70$, Wages of 1st.
$30 \times \$2.10 = \$63$, " 2d.
$22 \times \$2.10 = \$46.20$, " 3d.

(2.) $6 \times 20 = 120$
$5 \times 25 = 125$
$4 \times 24 = \underline{\ \ 96}$
$ 341$
$\frac{1}{341}$ of \$767.25 = \$2.25.
$120 \times \$2.25 = \$270$ = A's.
$125 \times \$2.25 = \$281.25$ = B's.
$96 \times \$2.25 = \$216$ = C's.

(3.)

$$\begin{array}{lr} & 12 \text{ sh.} \\ 3 \text{ cows} = 3 \times 3 \text{ sh.} = & 9 \text{ “} \\ 6 \text{ horses} = 6 \times 3 \times 3 \text{ sh.} = & \underline{54} \text{ “} \\ & 75 \text{ sh.} \end{array}$$

1 sh. $= \frac{1}{75}$ of \$900 = \$12.
1 c. = 3 × \$12 = \$36.
1 h. = 3 × \$36 = \$108.

(4.) 57 + 48 = 105
$\frac{1}{105}$ of 1260 = 12
57 × 12 = 684, First.
48 × 12 = 576, Second.

(6.) $\frac{1}{3} + \frac{2}{5} + \frac{5}{9} = \frac{58}{45}$ = \$72500
$\frac{1}{45} = \frac{1}{58}$ of \$72500 = \$1250
$\frac{15}{45}$ = 15 × \$1250 = \$18750 = $1\frac{1}{4}$ A's.
$\frac{18}{45}$ = 18 × \$1250 = \$22500 = $1\frac{1}{2}$ B's.
$\frac{25}{24}$ = 25 × \$1250 = \$31250 = $3\frac{1}{3}$ C's.
If $1\frac{1}{4}$ A's = \$18750
A's = $\frac{4}{5}$ of \$18750 = \$15000.
If $1\frac{1}{2}$ B's = \$22500
B's = $\frac{2}{3}$ of \$22500 = \$15000.
If $3\frac{1}{3}$ C's = \$31250
C's = $\frac{3}{10}$ of \$31250 = \$9375.

(7.) 1st. = S. + $\frac{1}{15}$
2d. = S.

Both = 2 S. + $\frac{1}{15} = 3\frac{1}{2}$
2 S. = $3\frac{1}{2} - \frac{1}{15} = \frac{103}{30}$
S. = $\frac{1}{2}$ of $\frac{103}{30} = \frac{103}{60} = 1\frac{43}{60}$.
1st. = $\frac{103}{60} + \frac{1}{15} = \frac{107}{60} = 1\frac{47}{60}$.

(8.) $G = E + \$27050$

$E = E$

$\text{Both} = 2\,E + \$27050 = \$81000$

$2\,E = \$81000 - \$27050 = \$53950$

$E = \frac{1}{2}$ of $\$53950 = \$26975$

$G = \$26975 + \$27050 = \$54025.$

(9.) $\text{1st.} = \text{2d.} + \$700$

$\text{3d.} = \text{2d.} - \$800$

$\text{2d.} = \text{2d.}$

$\text{All} = 3 \times \text{2d.} - \$100 = \$20900$

$3 \times \text{2d.} = \$20900 + \$100 = \$21000.$

$\text{2d.} = \frac{1}{3}$ of $\$21000 = \$7000.$

$\text{1st.} = \$7000 + \$700 = \$7700.$

$\text{3d.} = \$7000 - \$800 = \$6200.$

(10.) $\text{S.} = \text{S.}$

$\text{F.} = \text{S.} + \$600$

$\text{Th.} = \text{S.} + \$600 - \$1200$

$\text{All} = 3\ \text{S.} + \$1200 - \$1200 = 3\ \text{S.}$

$3\,\text{S.} = \$10800$

$\text{S.} = \frac{1}{3}$ of $\$10800 = \$3600.$

$\text{F.} = \$3600 + \$600 = \$4200.$

$\text{Th.} = \$4200 - \$1200 = \$3000.$

(11.) $B = 3\ C.$

$A = 4\ B = 12\ C.$

$C = C.$

$\text{All} = 16\ C = \$3456$

$C = \frac{1}{16}$ of $\$3456 = \$216.$

$B = 3 \times \$216 = \$648.$

$A = 12 \times \$216 = \$2592.$

(12.) $\frac{4}{5}$ S. = F.
$\frac{5}{5}$ S. + $\frac{4}{5}$ S. = $\frac{9}{5}$ S., or both.
$\frac{9}{5}$ S. = 6750
$\frac{1}{5}$ S. = $\frac{1}{9}$ of 6750 = 750
$\frac{4}{5}$ S. = 4 × 750 = 3000 = First.
$\frac{5}{5}$ S. = 5 × 750 = 3750 = Second.

(13.) $\frac{3}{4}$ D's = $\frac{5}{7}$ E's
$\frac{1}{4}$ D's = $\frac{1}{3}$ × $\frac{5}{7}$ E's = $\frac{5}{21}$ E's
$\frac{4}{4}$ D's = 4 × $\frac{5}{21}$ E's = $\frac{20}{21}$ E's
$\frac{20}{21}$ E's + $\frac{21}{21}$ E's = $\frac{41}{21}$ E's = 2255
$\frac{1}{21}$ E's = $\frac{1}{41}$ of 2255 = 55
D's = 20 × 55 = 1100.
E's = 21 × 55 = 1155.

(14.) $\frac{7}{9}$ F. = $\frac{6}{7}$ S.
$\frac{1}{9}$ F. = $\frac{1}{7}$ of $\frac{6}{7}$ S. = $\frac{6}{49}$ S.
$\frac{9}{9}$ F. = 9 × $\frac{6}{49}$ S. = $\frac{54}{49}$ S.
$\frac{54}{49}$ S. − $\frac{49}{49}$ S. = $\frac{5}{49}$ S. = 120
$\frac{1}{49}$ S. = $\frac{1}{5}$ of 120 = 24
$\frac{49}{49}$ S. = 49 × 24 = 1176 = Second.
$\frac{54}{49}$ S. = 54 × 24 = 1296 = First.

(15.) $\frac{3}{4}$ F. = $\frac{5}{6}$ S.
$\frac{1}{4}$ F. = $\frac{1}{3}$ × $\frac{5}{6}$ S. = $\frac{5}{18}$ S.
$\frac{4}{5}$ F. = 4 × $\frac{5}{18}$ S. = $\frac{20}{18}$ S.
$\frac{18}{18}$ S. + $\frac{20}{18}$ S. = $\frac{38}{18}$ S.
$\frac{38}{18}$ S. = $1\frac{7}{12}$ = $\frac{19}{12}$.
$\frac{1}{18}$ S. = $\frac{1}{38}$ of $\frac{19}{12}$ = $\frac{1}{24}$.
$\frac{18}{18}$ S. = 18 × $\frac{1}{24}$ = $\frac{3}{4}$ = Second.
$\frac{20}{18}$ S. = 20 × $\frac{1}{24}$ = $\frac{5}{6}$ = First.

(16.) $\frac{4}{5}$ W. = $\frac{3}{2}$ J.
$\frac{1}{5}$ W. = $\frac{1}{4} \times \frac{3}{2}$ J. = $\frac{3}{8}$ J.
$\frac{5}{5}$ W. = $5 \times \frac{3}{8}$ J. = $\frac{15}{8}$ J.
$\frac{15}{8}$ J. − $\frac{8}{8}$ J. = $\frac{7}{8}$ J. = \$637.
$\frac{1}{8}$ J. = $\frac{1}{7}$ of \$637 = \$91.
J. = $8 \times$ \$91 = \$728.
$\frac{15}{8}$ J. = W. = $15 \times$ \$91 = \$1365.

(17.) 5 A's = 8 B's.
A's = $\frac{1}{5}$ of 8 B's = $\frac{8}{5}$ B's.
$\frac{8}{5}$ B's + $\frac{5}{5}$ B's = $\frac{13}{5}$ B's = \$13650.
$\frac{1}{5}$ B's = $\frac{1}{13}$ of \$13650 = \$1050.
$\frac{5}{5}$ B's = $5 \times$ \$1050 = \$5250.
$\frac{8}{5}$ B's = $8 \times$ \$1050 = \$8400.

(18.)

$$\begin{array}{l} \text{Wheat} = 3 \text{ Corn} + 120 \\ \text{Corn} \quad = 1 \text{ Corn} \\ \hline 4 \text{ Corn} + 120 = 6720 \\ 4 \text{ Corn} = 6720 - 120 = 6600 \\ \quad \text{Corn} = \frac{1}{4} \text{ of } 6600 = 1650 \\ \quad 3 \times 1650 = 4950 \\ 4950 + 120 = 5070 = \text{Wheat.} \end{array}$$

(19.)

$$\begin{array}{rl} \text{Farm} = & 3 \text{ H.} + \$450 \\ \text{Store} = 2 \text{ F.} - \$650 = & 6 \text{ H.} + \$900 - \$650 \\ \text{House} = & \text{H.} \\ \hline & 10 \text{ H.} + \$1350 - \$650 = \$27700 \end{array}$$

10 H. + \$700 = \$27700
10 H. = \$27700 − \$700 = \$27000
H. = $\frac{1}{10}$ of \$27000 = \$2700.
F. = $3 \times$ \$2700 + \$450 = \$8100 + \$450 = \$8550
S. = $2 \times$ \$8550 − \$650 = \$17100 − \$650 = \$16450.

PERCENTAGE.

PAGE 185.

(3.) $.16 = 16\%; .125 = 12\frac{1}{2}\%; .875 = 87\frac{1}{2}\%; .33\frac{1}{3} = 33\frac{1}{3}\%; .00\frac{5}{6} = \frac{5}{6}\%$.

(4.) $.00\frac{3}{4} = \frac{3}{4}\%$; $\frac{15}{16} = .93\frac{3}{4} = 93\frac{3}{4}\%$; $\frac{3}{8} = .37\frac{1}{2} = 37\frac{1}{2}\%$; $\frac{5}{6} = .83\frac{1}{3} = 83\frac{1}{3}\%$.

PAGE 186.—*Oral Exercise.*

(8.) $33\frac{1}{3}\% = \frac{33\frac{1}{3}}{100}$, or $\frac{1}{3}$; $\frac{1}{3}$ of 15 sheep equals 5 sheep.

(9.) $56\frac{1}{4}\% = \frac{56\frac{1}{4}}{100}$, or $\frac{9}{16}$; $\frac{9}{16}$ of 120 cents equals $67\frac{1}{2}$ cents.

(10.) $87\frac{1}{2}\% = \frac{87\frac{1}{2}}{100}$, or $\frac{7}{8}$; $\frac{7}{8}$ of 96 yards equals 84 yards.

(11.) $3\frac{1}{3}\% = \frac{3\frac{1}{3}}{100}$, or $\frac{1}{30}$; $\frac{1}{3}$ of 90 bushels equals 30 bu.

(12.) $20\% = \frac{20}{100}$, or $\frac{1}{5}$; $\frac{1}{5}$ of 50 sheep equals 10 sheep; 50 sheep plus 10 sheep are 60 sheep.

(13.) $10\% = \frac{10}{100}$, or $\frac{1}{10}$; $\frac{1}{10}$ of $\$60 = \$6$; $\$60 - \$6 = \$54$.

(14.) $25\% = \frac{1}{4}$; $\frac{1}{4}$ of $\$2 = \$\frac{1}{2}$; $\$2 + \$\frac{1}{2} = \$2\frac{1}{2}$.

(15.) $120\% = \frac{120}{100}$, or $\frac{6}{5}$; $\frac{6}{5}$ of $75 = 90$; $90 + 75 = 165$.

(16.) $16\frac{2}{3}\% = \frac{16\frac{2}{3}}{100} = \frac{1}{6}$; $\frac{1}{6}$ of $\$36 = \$6$; $\$36 + \$6 = \$42$.

(17.) $15\% = \frac{3}{20}$; $\frac{3}{20}$ of $\$80 = \$12$; $30\% = \frac{3}{10}$; $\frac{3}{10}$ of $\$80 = \$24$; $25\% = \frac{1}{4}$; $\frac{1}{4}$ of $\$80 = \$20$; $\$12 + \$24 + \$20 = \$56$; $\$100 - \$56 = \$44$ = Remainder.

(18.) *Sug.* B has $4 \times \$40 = \$160$; $25\% = \frac{1}{4}$; $\frac{1}{4}$ of $\$160 = \$40$; A has $\$40 + \$40$, or $\$80$; B has $\$160 - \$40 = \$120$.

(19.) $15\% = \frac{15}{100}$; $\frac{15}{100}$ of $\$700 = \$105$. If $\$105 = \frac{7}{10}$, $\frac{1}{10} = \frac{1}{7}$ of $\$105 = \$15$; $\frac{10}{10} = 10 \times \$15 = \$150$. $12\% = \frac{12}{100}$, or $\frac{3}{25}$; $\frac{3}{25}$ of $\$150 = \$18$; $\$150 + \$18 = \$168$, the selling price.

(20.) $\frac{6}{6}$, or D's, plus $\frac{5}{6}$ D's $= \frac{11}{6}$ D's $= \$16500$; $\frac{1}{6}$ D's $= \frac{1}{11}$ of \$16500, or \$1500; $\frac{6}{6}$, or D's $= 6 \times \$1500$, or \$9000; $\frac{5}{6}$ D's, which equal C's, is $5 \times \$1500$, or \$7500. 20%, or $\frac{1}{5}$, of C's $= \frac{1}{5}$ of \$7500, which is \$1500. After buying 20% of C's, D had \$9000 plus \$1500, or \$10500, and C had $\$7500 - \$1500$, which is \$6000.

PAGE 187.—*Written Problems.*

(2.) $63\% = \frac{63}{100}$
$\frac{63}{100} \times 127$ A. $= 80.01$ A.

(3.) $19\% = \frac{19}{100}$
$\frac{19}{100} \times \$27 = \$5.13$.

(4.) $16\frac{1}{4}\% = \frac{16\frac{1}{4}}{100} = \frac{65}{400}$
$\frac{65}{400} \times \$127 = \$20.6275$.

(5.) $66\frac{1}{5}\% = \frac{66\frac{1}{5}}{100} = \frac{331}{500}$
$\frac{331}{500} \times \$186.50 = \$123.463$.

(6.) $\frac{1}{8}\% = \frac{\frac{1}{8}}{100} = \frac{1}{800}$
$\frac{1}{800} \times \$100 = \$.12\frac{1}{2}$.

(7.) $\frac{1}{2}$ of $7\frac{1}{2}\% = \dfrac{\frac{1}{2} \times 7\frac{1}{2}}{100} = \frac{15}{400}$
$\frac{15}{400} \times \$647 = \$24.26\frac{1}{4}$.

(11.) 12% of 25 £ 6 s. 6 d.
$= \frac{12}{100}$ of 25 £ 6 s. 6 d.
12
100)303 £ 18 s. 0 d.
3 £ 0 s. 9.36 d.

(12.) $25\% = \frac{1}{4}$
4)6 yd. 2 ft. 6 in.
1 yd. 2 ft. $1\frac{1}{2}$ in.

(13.) $\frac{1}{6}$ of $4\frac{1}{2}\% = \dfrac{\frac{1}{6} \times \frac{9}{2}}{100} = \frac{3}{400}$
$\frac{3}{400} \times \frac{5}{8}$ T. $= \frac{15}{3200}$ T.
$\frac{15}{3200} \times 2000$ lb. $= 9\frac{3}{8}$ lb.
$9\frac{3}{8}$ lb. = 9 lb. 6 oz.

(14.) $2\frac{1}{4} \times \frac{1}{3}\% = \frac{3}{4}\% = \frac{3}{400}$

$$\begin{array}{r} 66\frac{1}{2} \text{ gal.} = 66 \text{ gal. } 2 \text{ qt.} \\ 3 \\ \hline 400)\underline{199 \text{ gal. } 2} \text{ qt.} \\ 1 \text{ qt. } 1 \text{ pt. } 3\frac{24}{25} \text{ gi.} \end{array}$$

(15.) $16 \text{ T.} \times .63 = 10.08 \text{ T.} = 10 \text{ T. } 160 \text{ lb.}$

(16.) $26 \text{ T.} \times .02\frac{1}{2} = .65 \text{ T.} = 1300 \text{ lb.}$

(17.) $20\% + 25\% = 45\%$
$100\% - 45\% = 55\%$
$12600 \text{ T.} \times .55 = 6930 \text{ T.}$

(18.) $.12 \times \$3300 = \$396$
$\$3300 + \$396 = \$3696 = \text{A's.}$
$.05\frac{1}{4} \times \$3300 = \$173.25$
$\$3300 - \$173.25 = \$3126.75 = \text{B's.}$

(19.) $15\% + 20\% + 6\frac{1}{2}\% = 41\frac{1}{2}\%$
$100\% - 41\frac{1}{2}\% = 58\frac{1}{2}\%$
$.58\frac{1}{2} \times \$2550 = \$1491.75.$

(20.) $100\% - 25\% = 75\%$
$.75 \times \$2500 = \$1875$, 1st year.
$100\% - 35\% = 65\%$
$.65 \times \$2500 = \$1625$, 2d year.
$100\% - 42\frac{1}{2}\% = 57\frac{1}{2}\%$
$.57\frac{1}{2} \times \$2500 = \$1437.50$, 3d year.
$\$1875 + \$1625 + \$1437.50 = \$4937.50.$

PAGE 188. CASE II.—*Oral Exercise.*

14. 36 gal. − 20 gal. = 16 gal. 16 gal. is $\frac{4}{9}$ of 36 gal., or $\frac{4}{9}$ of 100%, which is $44\frac{4}{9}\%$.

15. 60 cents is $\frac{2}{3}$ of 90 cents, or $\frac{2}{3}$ of 100%, which is $66\frac{2}{3}\%$. If he spent $66\frac{2}{3}\%$, he had remaining $100\% - 66\frac{2}{3}\%$, or $33\frac{1}{3}\%$.

16. 6 eggs is $\frac{1}{8}$ of 4 doz. eggs, or $\frac{1}{8}$ of 100%, which is 12$\frac{1}{2}$%. Hence, 100% − 12$\frac{1}{2}$%, or 87$\frac{1}{2}$%, of the eggs were good.

17. $\frac{2}{5}$ of \$25 is \$10; $\frac{3}{4}$ of \$96 is \$72; \$10 is $\frac{10}{72}$ of \$72, or $\frac{10}{72}$ of 100%, which is 13$\frac{8}{9}$%.

18. $\frac{3}{5}$ of 20% is 12%; 2$\frac{1}{2}$ times 12% is 30%; 12% is $\frac{2}{5}$ of 30%, or $\frac{2}{5}$ of 100% of 30%, which is 40% of 30%.

19. $\frac{1}{4}$ plus $\frac{1}{8}$ equals $\frac{3}{8}$. If he spent $\frac{3}{8}$, there remained $\frac{8}{8}$ minus $\frac{3}{8}$, or $\frac{5}{8}$, which is equal to 62$\frac{1}{2}$%.

20. If 25 was $\frac{5}{12}$ of the remainder, $\frac{1}{12}$ of the remainder was $\frac{1}{5}$ of 25, or 5, and $\frac{12}{12}$, or the remainder, was 12 times 5, or 60. After selling $\frac{1}{3}$, there remained $\frac{2}{3}$, equal to 60; $\frac{1}{3}$ of his number was $\frac{1}{2}$ of 60, or 30, and $\frac{3}{3}$, or his number, was 3 times 30, or 90. Had he sold 40, he would have had 50 remaining, or $\frac{5}{9}$ of his original number, which is equal to 55$\frac{5}{9}$%.

PAGE 139.—*Written Problems.*

(2.) 180 ÷ 300 = .6 = 60%.

(3.) 56 ÷ 160 = .35 = 35%.

(5.) 120.15 ÷ 890 = .13$\frac{1}{2}$ = 13$\frac{1}{2}$%.

(6.) 19.20 ÷ 18 = 1.06$\frac{2}{3}$ = 106$\frac{2}{3}$%.

(7.) 90.88 ÷ 640 = .14$\frac{1}{5}$ = 14$\frac{1}{5}$%.

(8.) 15 A. ÷ 24 A. = .62$\frac{1}{2}$ = 62$\frac{1}{2}$%.

(9.) 1$\frac{1}{2}$ lb. ÷ 60 lb. = .02$\frac{1}{2}$ = 2$\frac{1}{2}$%.

(10.) 1 S. ÷ 20 S. = .05 = 5%.

(11.) 3 pk. ÷ 24 pk. = .12$\frac{1}{2}$ = 12$\frac{1}{2}$%.

(12.) 3 qt. ÷ 40 qt. = .07$\frac{1}{2}$ = 7$\frac{1}{2}$%.

(13.) 9 gal. ÷ 2$\frac{1}{2}$ gal. = 3.60 = 360%.

(14.) 5760 gr. ÷ 7000 gr. = .82$\frac{2}{7}$ = 82$\frac{2}{7}$%.

(15.) $\$2100 \div \$6000 = .35 = 35\%$.

(16.) $\$1200 + \$100 = \$1300$
$\$1500 - \$1300 = \$200$
$\$200 \div \$1200 = .16\frac{2}{3} = 16\frac{2}{3}\%$.

(17.) $\$6000 + \$8960 + \$9600 = \$24560$
$6000 \div 24560 = .24\frac{132}{307} = 24\frac{132}{307}\%$, 1st.
$8960 \div 24560 = .36\frac{148}{307} = 36\frac{148}{307}\%$, 2d.
$9600 \div 24560 = .39\frac{27}{307} = 39\frac{27}{307}\%$, 3d.

(18.) $.23 \times \$6000 = \$1380$
$\$6000 + \$1380 = \$7380$
$.20 \times \$7380 = \$1476$
$\$7380 - \$1476 = \$5904$
$5904 \div 6000 = .98\frac{2}{5} = 98\frac{2}{5}\%$.

CASE III.—PAGE 190.

Answers.

(2.) 125.	(4.) 1200.	(6.) 120.
(3.) 500.	(5.) $12\frac{1}{2}$.	(7.) $12\frac{1}{2}$ cwt.

8. $15\% = \frac{3}{50}$; if 3 qt. is $\frac{3}{50}$, $\frac{1}{50}$ is $\frac{1}{3}$ of 3 qt., or 1 qt., and $\frac{50}{50}$ is 50 times 1 qt., which is 50 qt., or $12\frac{1}{2}$ gal.

9. If \$60 is $37\frac{1}{2}\%$ of the cost, it is $\frac{37\frac{1}{2}}{100}$, or $\frac{3}{8}$ of the cost.

10. If 14% is \$630, 1% is $\frac{1}{14}$ of \$630, or \$45, and 100% is 100 times \$45, or \$4500.

11. If \$600 is $12\frac{1}{2}\%$, or $\frac{1}{8}$, of the value, the value is 8 times \$600, or \$4800.

12. If \$40 is 8% or $\frac{2}{25}$, $\frac{1}{25}$ is $\frac{1}{2}$ of \$40, or \$20, and $\frac{25}{25}$ is 25 times \$20, or \$500. 9 times the cost of the chain added to the cost of the chain equals 10 times the cost of the chain, or \$500; hence, the chain cost $\frac{1}{10}$ of \$500, or \$50, and the watch 9 times \$50, or \$450.

13. If 480 tons is $12\frac{1}{2}\%$, or $\frac{1}{8}$, $\frac{8}{8}$ is 8 times \$480, or \$3840.

14. If a farmer sold $37\frac{1}{2}\%$ of his corn, there remained $62\frac{1}{2}\%$, or $\frac{5}{8}$, which is 2500 bushels; $\frac{1}{8}$ is $\frac{1}{5}$ of 2500 bushels, or 500 bushels, and $\frac{8}{8}$ is 8 times 500 bushels, which is 4000 bushels, the entire crop.

15. $75\% = \frac{3}{4}$; $\frac{3}{4}$ of \$8400 is \$6300; 60%, or $\frac{3}{5}$ of \$6300, is \$3780, which is 72%, or $\frac{18}{25}$ of the cost of the farm; $\frac{1}{25}$ of the cost is $\frac{1}{18}$ of \$3780, or \$210, and $\frac{25}{25}$, or the cost, is 25 times \$210, which is \$5250.

PAGE 191.—*Written Problems.*

(5.) $112\frac{1}{2}\% = \$225$
$1\% = 225 \div 112\frac{1}{2} = \$2$
$100\% = 100 \times \$2 = \$200.$

(6.) $62\frac{1}{2}\% = \$11562.50$
$1\% = 11562.50 \div 62\frac{1}{2} = \$185$
$100\% = 100 \times \$185 = \$18500.$

(7.) $31\% = \$6.51$
$1\% = \frac{1}{31}$ of $\$6.51 = \$.21$
$100\% = 100 \times \$.21 = \$21.$

(8.) $54\% = \$36$
$1\% = \frac{1}{54}$ of $\$36 = 66\frac{2}{3}¢$
$100\% = 100 \times 66\frac{2}{3}¢ = \$66.66\frac{2}{3}$
$\$66.66\frac{2}{3} - \$36 = \$30.66\frac{2}{3}$. *Ans.*

(9.) $83\% = 996$
$1\% = \frac{1}{83}$ of $996 = 12$
$100\% = 100 \times 12 = 1200.$ *Ans.*

(10.) $21\% = 13650$
$1\% = \frac{1}{21}$ of $13650 = 650$
$100\% = 100 \times 650 = 65000.$

PAGE 192.

(11.) $25\% + 15\% + 12\frac{1}{2}\% = 52\frac{1}{2}\%$
$100\% - 52\frac{1}{2}\% = 47\frac{1}{2}\%$
$47\frac{1}{2}\% = \$712.50$
$1\% = \$712.50 \div 47\frac{1}{2} = \$15$
$100\% = 100 \times \$15 = \$1500.$

(12.) $25\% = \frac{1}{4}$
$\frac{1}{4}$ of $\frac{3}{4} = \frac{3}{16}$
$\frac{3}{16} = \$24000$
$\frac{1}{16} = \frac{1}{3}$ of $\$24000 = \$8000$
$\frac{16}{16} = 16 \times \$8000 = \$128000.$

(13.) 13% = 13 A. 1 R. 38 P.
$1\% = \frac{1}{13}$ of 13 A. 1 R. 38 P.
= 1 A. 0 R. 6 P.
$100\% = 100 \times$ 1 A. 0 R. 6 P.
= 103 A. 3 R.

(14.) $100\% - 20\% = 80\%$
20% of $80\% = \frac{1}{5}$ of $80\% = 16\%$
$16\% = \$2560$
$1\% = \frac{1}{16}$ of $\$2560 = \$160$
$100\% = 100 \times \$160 = \$16000.$

(15.) $7\% = 175$
$1\% = \frac{1}{7}$ of $175 = 25$
$100\% = 100 \times 25 = 2500$, No. at first.
$2500 + 175 = 2675$
$.24 \times 2675 = 642$, No. sold.
$2675 - 642 = 2033$, Rem.
$2033 \div 2500 = .81\frac{8}{25} = 81\frac{8}{25}\%.$

(16.) 100% = 1st.
135% = 2d.
$\underline{145\%}$ = 3d.
380% = $4560
1% = $\frac{1}{380}$ of $4560 = $12
100% = 100 × $12 = $1200 = 1st.
135% = 135 × $12 = $1620 = 2d.
145% = 145 × $12 = $1740 = 3d.

CASE IV.—*Oral Exercise.*

5. $16\frac{2}{3}\%$ = $\frac{1}{6}$; $\frac{6}{6}$ plus $\frac{1}{6}$ equals $\frac{7}{6}$, or $7; $\frac{1}{6}$ equals $\frac{1}{7}$ of $7, which is $1, and $\frac{6}{6}$ is 6 times $1, or $6.

12. 100% − 17% = 83%, or $\frac{83}{100}$, which equals 747; $\frac{1}{100}$ is $\frac{1}{83}$ of 747, which is 9, and $\frac{100}{100}$ is 100 times 9, or 900.

13. 100% + 17% = 117%, or $\frac{117}{100}$, which equals 819; $\frac{1}{100}$ is $\frac{1}{117}$ of 819, or 7, and $\frac{100}{100}$ is 100 times 7, or 700.

14. 40% − 16% is 24%; 100% + 24% equals 124%, or $\frac{31}{25}$, which equals 372; $\frac{1}{25}$ is $\frac{1}{31}$ of 372, or 12, and $\frac{25}{25}$ is 25 times 12, which is 300.

15. $33\frac{1}{3}\%$ = $\frac{1}{3}$; $\frac{3}{3}$ + $\frac{1}{3}$, or $\frac{4}{3}$, of what the first has, equals what the second has; $\frac{3}{3}$ + $\frac{4}{3}$, or $\frac{7}{3}$, of the first equals what both have, or 63; $\frac{1}{3}$ equals $\frac{1}{7}$ of 63, or 9, and $\frac{3}{3}$, or the first, equals 3 times 9, which is 27, and $\frac{4}{3}$ is 4 times 9, or 36, which is what the second has.

16. 30% equals $\frac{3}{10}$; hence C has $\frac{10}{10}$ and D $\frac{13}{10}$, or both have $\frac{10}{10}$ plus $\frac{13}{10}$, which is $\frac{23}{10}$, equal to $2300. $\frac{1}{10}$ equals $\frac{1}{23}$ of $2300, or $100, and $\frac{10}{10}$ equals 10 times $100, or $1000, and $\frac{13}{10}$ equals 13 times $100, or $1300.

17. 100% plus 40% equals 140%, or $\frac{7}{5}$. $\frac{7}{5}$ + 12 feet equals twice the length, or $\frac{10}{5}$; $\frac{10}{5}$ minus $\frac{7}{5}$, or $\frac{3}{5}$, of the length, is 12 feet; $\frac{1}{5}$ of the length is $\frac{1}{3}$ of 12 feet, or 4 feet, and $\frac{5}{5}$, or the length, is 5 times 4 feet, which is 20 feet.

18. 100% plus 40% equals 140%; 140%, or $\frac{7}{5}$, of the cost of the house equals the cost of the store, which added to the cost of the house equals $\frac{12}{5}$ of the cost of the house, or the cost of both, which is \$6000; $\frac{1}{5}$ of the cost of the house is $\frac{1}{12}$ of \$6000, which is \$500, and $\frac{5}{5}$, or the cost of the house, is 5 times \$500, or \$2500, and $\frac{7}{5}$, or the cost of the store, is 7 times \$500, or \$3500.

PAGE 194.—*Written Problems.*

(6.) $100\% + 20\% = 120\%$
$120\% = \frac{6}{5}\text{ No.} = \frac{3}{4}$
$\frac{1}{5} = \frac{1}{6}\text{ of }\frac{3}{4} = \frac{3}{24}$
$\frac{5}{5} = 5 \times \frac{3}{24} = \frac{15}{24} = \frac{5}{8}.$

(7.) $100\% - 40\% = 60\%$
$60\% = \frac{3}{5}\text{ No.}$
$\frac{3}{5}\text{ No.} = \frac{3}{7}$
$\frac{1}{5}\text{ No.} = \frac{1}{3}\text{ of }\frac{3}{7} = \frac{1}{7}$
$\frac{5}{5}\text{ No.} = 5 \times \frac{1}{7} = \frac{5}{7}.$

(8.) $100\% - 66\% = 34\% = \frac{17}{50}$
$\frac{17}{50} = \$306$
$\frac{1}{50} = \frac{1}{17}\text{ of }\$306 = \$18$
$\frac{50}{50} = 50 \times \$18 = \$900.$

(9.) $100\% - 15\% = 85\% = \frac{17}{20}$
$\frac{17}{20} = 34\text{ yd.}$
$\frac{1}{20} = \frac{1}{17}\text{ of }34\text{ yd.} = 2\text{ yd.}$
$\frac{20}{20} = 20 \times 2\text{ yd.} = 40\text{ yd.}$

(10.) $67\% = \$3350$
$1\% = \frac{1}{67}\text{ of }\$3350 = \$50$
$100\% = 100 \times \$50 = \$5000.$

(11.) $27\% = \$4546.80$
$1\% = \frac{1}{27}\text{ of }\$4546.80 = \$168.40$
$100\% = 100 \times \$168.40 = \$16840.$

(12.) $135\% = 1161$
$1\% = \frac{1}{135}\text{ of }1161 = 8.6$
$100\% = 100 \times 8.6 = 860.$

(13.) $172\% = 11180$
$1\% = \frac{1}{172} \times 11180 = 65$
$100\% = 100 \times 65 = 6500.$

(14.) $100\% + 107\% = 207\%$
$207\% = \$3105$
$1\% = \frac{1}{207}$ of $\$3105 = \$15$
$100\% = 100 \times \$15 = \$1500$
$107\% = 107 \times \$15 = \$1605.$

(15.) $100\% - 12\frac{1}{2}\% = 87\frac{1}{2}\% = \frac{7}{8}$
$\frac{7}{8} = \$7000$
$\frac{1}{8} = \frac{1}{7}$ of $\$7000 = \$1000$
$\frac{8}{8} = 8 \times \$1000 = \$8000$
$100\% + 16\frac{2}{3}\% = 116\frac{2}{3}\% = \frac{7}{6}$
$\frac{1}{6} = \frac{1}{7}$ of $\$7000 = \$1000$
$\frac{6}{6} = 6 \times \$1000 = \$6000.$

(16.) $112\frac{1}{2}\% = \frac{9}{8} = \$1$
$\frac{1}{8} = \frac{1}{9}$ of $\$1 = \$\frac{1}{9}$
$\frac{8}{8} = 8 \times \$\frac{1}{9} = \$\frac{8}{9} = 88\frac{8}{9}¢.$

(17.) $100\% + 115\% = 215\%$
$215\% = \$1$
$1\% = \frac{1}{215}$ of $\$1 = \$\frac{1}{215}$
$100\% = 100 \times \$\frac{1}{215} = \$\frac{100}{215} = 46\frac{22}{43}¢.$

(18.) $100\% - 40\% = 60\% = \$3200$
$1\% = \frac{1}{60}$ of $\$3200 = \$53.33\frac{1}{3}$
$100\% = 100 \times \$53.33\frac{1}{3} = \$5333\frac{1}{3}.$

(19.) 100% − 59% = 41%
41% = $2460
1% = $\frac{1}{41}$ of $2460 = $60
100% = 100 × $60 = $6000
100% B's + 60% B's = 160%, or $\frac{8}{5}$, B's = Both.
$\frac{1}{5} = \frac{1}{8}$ of $6000 = $750
$\frac{5}{5}$ = 5 × $750 = $3750
$\frac{3}{5}$ = 3 × $750 = $2250.

(20.) 100% + 15½% = 115½% = $\frac{231}{200}$
$\frac{1}{200} = \frac{1}{231}$ of $1386 = $6
$\frac{200}{200}$ = 200 × $6 = $1200.

PROFIT AND LOSS.

PAGE 196.—*Oral Exercise.*

8. *Sug.* 25% = $\frac{1}{4}$; $\frac{1}{4}$ of $120 = $30; $120 + $30 = $150; 10% = $\frac{1}{10}$; $\frac{1}{10}$ of $150 = $15; $150 + $15 = $165 = Amount C paid.

9. *Sug.* 10%, or $\frac{1}{10}$, of $1200 = $120; 12%, or $\frac{3}{25}$, of $1500 = $180. If he gained $180 and lost $120, he lost the difference, or $60.

10. *Sug.* 12 cows at $60 each are worth $720. If he gained 35%, he gained $\frac{7}{20}$; $\frac{1}{20}$ of $720 is $36, and $\frac{7}{20}$ is 7 times $36, or $252; $720 plus $252 equals $972.

Written Problems.

(3.) .15 × $560 = $84
$560 + $84 = $644.

(4.) 500 × $4.20 = $2110.
.27 × $2110 = $567, Total gain.
$\frac{1}{500}$ of $567 = $1.13⅖, Gain per ton.

(5.) 700 × $1.20 = $840
.15½ × $840 = $130.20
$130.20 − $28 = $102.20. *Ans.*

(6.) $2.60 + $1.30 = $3.90, Cost.
.30 × $3.90 = $1.17, Gain.
$3.90 + $1.17 = $5.07. *Ans.*

(7.) 60 × $6 = $360
$360 + $36 = $396
.30 × $396 = $118.80, Gain.
$396 + $118.80 = $514.80
$514.80 ÷ 60 = $8.58. Price per bbl.

(8.) $\frac{1}{16}$ of $464.80 = $29.05
.18 of $29.05 = $5.229. *Ans.*

(9.) 6% − 1⅘% = 4⅕%
.04⅕ × $6740 = $283.08. *Ans.*

(10.) .12 × $16500 = $1980
$16500 + $1980 = $18480 = B's.
.03 × $18480 = $554.40
$18480 − $554.40 = $17925.60 = C's.

PAGE 197.—*Oral Exercise.*

5. *Sug.* He lost on a bushel 50¢ − 35¢, or 15¢; 15¢ is $\frac{3}{10}$ of 50¢, or $\frac{3}{10}$ of 100%, which is 30%.

6. *Sug.* The chickens cost 7¢ + 1¢, or 8¢, per pound. If they were sold for 11¢ per pound, the gain was 3¢ per pound, or 3¢ on 8¢, which is a gain of ⅜ of 100%, or 37½%.

7. If a fruit-dealer buys lemons at 15 cents a dozen, they cost him 1¼ cents apiece. If he sells them at 2 for 5 cents, he receives 2½ cents each. His gain is 2½ cents − 1¼ cents, or 1¼ cents. Hence, the gain equals the cost, or it is 100%.

8. If $140 is $\frac{2}{3}$ of the cost of a horse, $\frac{1}{3}$ of the cost is $\frac{1}{2}$ of $140, or $70, and $\frac{3}{3}$ is 3 times $70, or $210. He gained the difference between $273 and $210, which is $63. $63 is $\frac{3}{10}$, or 30%, of $210.

9. If $\frac{3}{5}$ of a farm is sold for the value of $\frac{2}{3}$ of it, $\frac{1}{5}$ is sold for $\frac{1}{3}$ of $\frac{2}{3}$, or $\frac{2}{9}$, of the value, and $\frac{5}{5}$ is sold for 5 times $\frac{2}{9}$, or $\frac{10}{9}$ of the value. The gain is therefore $\frac{10}{9} - \frac{9}{9}$, or $\frac{1}{9}$, which is equal to $11\frac{1}{9}$%.

10. Since there are 64 pints in a bushel, the retail value was 64 times 10 cents, or $6.40, and the gain was the difference between $6.40 and $4, or $2.40, which is $\frac{3}{5}$, or 60%, of $4.

Page 198.—*Written Problems.*

(5.) $\$240 - \$220 = \$20$
$20 \div 220 = \frac{1}{11}$, or $9\frac{1}{11}$%.

(6.) $.25 \times \$5000 = \$1250$
$\$5000 - \$1250 = \$3750$
40% of $\$3750 = \$1500$
$\$3750 + \$1500 = \$5250$
$\$5250 - \$5000 = \$250$
$\$250 \div \$5000 = \frac{1}{20}$, or 5%.

(7.) $\frac{1}{10}$ of $\$125 = \$12.50$
$\$125 - \$12.50 = \$112.50$
$\$120 - \$112.50 = \$7.50$
$7.50 \div 112.50 = 6\frac{2}{3}$%.

(8.) $\frac{7}{12} = \$147$
$\frac{1}{12} = \frac{1}{7}$ of $\$147 = \$21$
$\frac{12}{12} = 12 \times \$21 = \$252$
$\$300 - \$252 = \$48$
$48 \div 252 = 19\frac{1}{2}$%.

(9.) $\$620 - \$500 = \$120$
$120 \div 620 = 19\frac{11}{31}$%.

(10.) $\frac{7}{8} = \frac{2}{3}$
$\frac{1}{8} = \frac{1}{7}$ of $\frac{2}{3} = \frac{2}{21}$
$\frac{8}{8} = 8 \times \frac{2}{21} = \frac{16}{21}$
$\frac{21}{21} - \frac{16}{21} = \frac{5}{21} = 23\frac{17}{21}\%$.

CASE III.—PAGE 199.

(4.) 13% = 39¢
1% = $\frac{1}{13}$ of 39¢ = 3¢
100% = 100 × 3¢ = $3
8% = $\frac{8}{100}$, or $\frac{2}{25}$
$\frac{2}{25}$ × $3 = 24¢
$3 + $.24 = $3.24.

(5.) 23% = $16.56
1% = 72¢
100% = $72
$\frac{1}{24}$ of $72 = $3.

(6.) 44% = $23.76
1% = $\frac{1}{44}$ of $23.76 = $.54
100% = 100 × $.54 = $54
16% of $54 = $8.64
$54 + $8.64 = $62.64
$\frac{1}{12}$ of $62.64 = $5.22.

CASE IV. PAGE 200.—*Oral Exercise.*

6. $16\frac{2}{3}\% = \frac{1}{6}$; $\frac{6}{6} - \frac{1}{6} = \frac{5}{6}$, or 15 cents, $\frac{1}{6} = \frac{1}{5}$ of 15 cents, or 3 cents, and $\frac{6}{6}$ equals 6 times 3 cents, or 18 cents.

7. $12\frac{1}{2}\% = \frac{1}{8}$; $\frac{8}{8} - \frac{1}{8} = \frac{7}{8}$, which equals 70 cents; $\frac{1}{8}$ is $\frac{1}{7}$ of 70 cents, or 10 cents, and $\frac{8}{8}$ is 8 times 10 cents, or 80 cents. By selling at 75 cents a bushel I would lose 80 cents minus 75 cents, or 5 cents, which is $\frac{1}{16}$, or $6\frac{1}{4}\%$, of 80.

8. $12\frac{1}{2}\%$ equals $\frac{1}{8}$; $\frac{8}{8}$ plus $\frac{1}{8}$ equals $\frac{9}{8}$, which is 90 cents. $\frac{1}{8}$ equals $\frac{1}{9}$ of 90 cents, or 10 cents, and $\frac{8}{8}$ equals 8 times 10 cents, or 80 cents. If I were to sell at 65 cents, I would lose 80 cents minus 65 cents, or 15 cents, which is $\frac{15}{80}$, or $\frac{3}{16}$, equal to $18\frac{3}{4}\%$ of the cost.

9. 25% equals $\frac{1}{4}$; $\frac{4}{4}$ plus $\frac{1}{4}$, or $\frac{5}{4}$, equals the selling price of the first book, which is $3. If $\frac{5}{4}$ of the cost is $3, $\frac{1}{4}$

of the cost is $\frac{1}{5}$ of \$3, or \$$\frac{3}{5}$, and $\frac{4}{4}$, or the cost, is 4 times \$$\frac{3}{5}$, or \$$\frac{12}{5}$, which is \$2.40. I therefore gained on the first \$3 minus \$2.40, or 60 cents. On the second I lost 20%, or $\frac{1}{5}$; hence, I sold it for $\frac{4}{5}$ of its value. If \$3 is $\frac{4}{5}$ of its value, $\frac{1}{5}$ of its value is $\frac{1}{4}$ of \$3, or \$$\frac{3}{4}$, and $\frac{5}{5}$, or its value, is 5 times \$$\frac{3}{4}$, or \$$\frac{15}{4}$, which is \$3.75. I therefore lost on the second \$3.75 minus \$3, or 75 cents. If my loss on one book was 75 cents, and my gain on the other was 60 cents, my total loss was 75 cents less 60 cents, or 15 cents.

PAGE 201.—*Written Problems.*

(3.) 13% + 100% = 113%
\$96.05 ÷ 1.13 = \$85 = Cost
\$96.05 − \$85 = \$11.05
\$11.05 × 65 = \$718.25.

(4.) $22\frac{1}{2}$% + 100% = $122\frac{1}{2}$%
1543.50 ÷ $1.22\frac{1}{2}$ = 1260
\$1543.50 − \$1260 = \$283.50. *Ans.*

(5.) 100% + 27% = 127%
8128 ÷ 1.27 = 6400. *Ans.*

(6.) 100% + 15% = 115% = $\frac{28}{20}$ = 92¢
$\frac{1}{20}$ = $\frac{1}{28}$ of 92¢ = 4¢
$\frac{20}{20}$ = 20 × 4¢ = 80¢
.$18\frac{3}{4}$ × 80¢ = 15¢
80¢ + 15¢ = 95¢.

(7.) \$1425 − \$175 = \$1250
\$1600 − \$1250 = \$350
350 ÷ 1250 = 28%.

(8.) $13\% + 100\% = 113\% = \$7345$
$1\% = \frac{1}{113}$ of $\$7345 = \$65$
$100\% = 100 \times \$65 = \$6500$
$\$7500 - \$6500 = \$1000$
$1000 \div 6500 = 15\frac{5}{13}\%$.

(9.) $100\% + 8\% = 108\%$
$2484 \div 1.08 = 2300$, Cost of 1st.
$\$2484 - \$2300 = \$184$, Gain.
$100\% - 8\% = 92\%$
$\$2484 \div .92 = \$2700$, Cost of 2d.
$\$2700 - \$2484 = \$216$, Loss.
$\$216 - \$184 = \$32$, Loss.

(10.) $100\% + 35\% = 135\% = \frac{27}{20}$
$\frac{27}{20} = \$297$
$\frac{1}{20} = \frac{1}{27}$ of $\$297 = \$11$
$\frac{20}{20} = 20 \times \$11 = \$220$
$\$300 - \$220 = \$80$
$80 \div 220 = 36\frac{4}{11}\%$.

COMMISSION AND BROKERAGE.

Case I.—Page 202.—*Oral Exercise.*

5. 600 barrels at \$7.50 a barrel are worth 600 times \$7.50, or \$4500. $1\frac{1}{2}\%$, or $\frac{3}{200}$, of \$4500 equals \$67.50.

Written Problems.

(2.) $\$12350 \times .00\frac{1}{2} = \$61.75$.

(3.) $12600 \times \$1.37 = \$17262$
$\$17262 \times .03\frac{1}{2} = \$604.17$.

(4.) 60×380 lb. $= 22800$ lb.
$22800 \times 11\frac{1}{2}¢ = \$2622$
$\$2622 \times .02\frac{3}{4} = \$72.10\frac{1}{2}$.

(5.)
$$\begin{aligned} 640 \times \$.17 &= \$108.80 \\ 850 \times \$.33 &= \$280.50 \\ 1260 \times \$.27 &= \$340.20 \\ 2750 \times \$.08\tfrac{1}{2} &= \underline{\$233.75} \\ & \$963.25 \end{aligned}$$
$\$963.25 \times .03\frac{3}{4} = \$36.12$
$\$963.25 - \$36.12 = \$927.13$.

(6.) $\$650.50 \times .05 = \$32.525$
$\$32.525 + \$23.75 = \$56.275$
$\$650.50 - \$56.275 = \$594.225$.

CASE II.—PAGE 204.

(3.) $640 \times \$.60 = \$384$
$17.28 \div 384 = .04\frac{1}{2}$, or $4\frac{1}{2}\%$.

(4.) $127 \times \$7.50 = \$952.50$, Cost.
$\$70 - \$12.85 = \$57.15$, Commission.
$\$57.15 \div \$952.50 = 6\%$.

(5.) $\$6300 + \$27 + \$6.70 = \$6333.70$, Cost.
$\$6680.20 - \$6333.70 = \$346.50$, Commission.
$346.50 \div 6300 = 5\frac{1}{2}\%$.

CASE III.—PAGE 205.

(3.) $3\frac{1}{2}\% = .035$
$171.78 \div .035 = 4908$. *Ans.*

(4.) $4\frac{1}{2}\% = .045$
$57.825 \div .045 = 1285$. *Ans.*

(5.) $2\frac{1}{2}\% = .025$
$25.50 \div .025 = 1020$
$\frac{1}{120}$ of $\$1020 = \$8.50$
$\$1020 - \$25.50 = \$994.50$

CASE IV.—PAGE 206.—*Oral Exercise.*

2. $6\% = \frac{3}{50}$; $\frac{50}{50} + \frac{3}{50} = \frac{53}{50}$, which equals $318; $\frac{1}{50}$ equals $\frac{1}{53}$ of $318, or $6, and $\frac{50}{50}$, the amount expended, equals 50 times $6, or $300.

3. $6\frac{1}{4}\% = \frac{1}{16}$; $\frac{16}{16}$, the amount invested, plus $\frac{1}{16}$, the commission, equals $\frac{17}{16}$ of the amount invested, or $3000; hence $\frac{1}{16}$ of the amount invested is $\frac{1}{17}$ of $3000, or $\$176\frac{8}{17}$, and $\frac{16}{16}$ is 16 times $\$176\frac{8}{17}$, or $\$2823\frac{9}{17}$.

4. $5\% = \frac{1}{20}$; $\frac{20}{20}$ plus $\frac{1}{20}$ equals $\frac{21}{20}$ of the cost, or $441; $\frac{1}{20}$ equals $\frac{1}{21}$ of $441, or $21, and $\frac{20}{20}$ equals 20 times $21, or $420. If a barrel costs $7, for $420 as many barrels can be bought as 7 is contained times in 420, or 60.

5. 8% equals $\frac{2}{25}$; $\frac{25}{25}$ plus $\frac{2}{25}$ equals $\frac{27}{25}$; hence $\frac{27}{25}$ of the farmer's share equals 540 bu.; $\frac{1}{25}$ equals $\frac{1}{27}$ of 540 bu., or 20 bu., and $\frac{25}{25}$ is 25 times 20 bu., or 500 bu., the farmer's share; the laborer's share is 540 bu. minus 500 bu., or 40 bu.

Written Problems.

(3.) $\$1610 - \$11 = \$1599$
$100\% + 2\frac{1}{2}\% = 102\frac{1}{2}\%$
$1599 \div 1.02\frac{1}{2} = 1560.$ *Ans.*

(4.) $125 \times \$48 = \$6000$
$\frac{1}{2}\%$ of $\$6000 = \$30$
$\$6000 - \$30 = \$5970$
$\$5970 \div \$39.80 = 150.$

(5.) 160 × $6.25 = $1000
3% of $1000 = $30
$1000 − $30 = $970
$970 − $5.75 = $964.25
100% + 1½% = 101½% = $964.25
964.25 ÷ 1.01½ = 950
$950 ÷ $19 = 50.

Note.—In one edition of the book the cartage is stated as being $5.45; it should be $5.75.

(6.) 100% + 1½% = 101½%
629.30 ÷ 1.01½ = 620. *Ans.*

INSURANCE.

Page 208.—*Oral Exercise.*

5. $40 is $\frac{1}{50}$, or 2%, of $2000; hence the premium is 2%.

Remark.—The 6th and the 7th are solved in the same way.

8. 4%, or $\frac{1}{25}$ of the value of the property, is $60; $\frac{25}{25}$ is 25 times $60, or $1500.

9. 1½% equals $\frac{3}{200}$. If $\frac{3}{200}$ of the value is $21, $\frac{1}{200}$ is $\frac{1}{3}$ of $21, or $7, and $\frac{200}{200}$ equals 200 times $7, or $1400.

10. ¾% equals $\frac{3}{400}$. If $\frac{3}{400}$ of the value is $4.50, $\frac{1}{400}$ is $\frac{1}{3}$ of $4.50, or $1.50, and $\frac{400}{400}$ is 400 times $1.50, or $600.

Page 208.—*Written Problems.*

(4.) $3500 × .01¾ = $61.25
$3000 × .00¾ = $22.50
$61.25 + $22.50 = $83.75

(5.) $\$5500 \times .01\frac{1}{4} = \$68.75$
$\$3300 \times .01 = \$33.00$
$\$1500 \times .01\frac{1}{8} = \underline{\$16.87\frac{1}{2}}$
$\$118.62\frac{1}{2}$

(6.) $1500 \times \$1.10 = \$1650$, Val.
$1500 \times \$1.20 = \$1800$
$\$1800 \times .02\frac{1}{2} = \$45$, Prem.
$\$1800 - \$45 = \$1755$
$\$1755 - \$1650 = \$105$, Gain.

(7.) $\$6000 \times .02\frac{1}{4} = \$135$, Prem.
$\$6000 \times .65\frac{3}{4} = \$3945$
$\$3945 - \$135 = \$3810$. *Ans.*

(8.) $\frac{3}{4} \times \$150000 = \$112500$
$\frac{1}{5}$ of $\$112500 = \$22500$
$\$22500 \times .00\frac{3}{5} = \$135$, 1st. Prem.
$\frac{1}{4} \times \$112500 = \$28125$
$\$28125 \times .00\frac{3}{4} = \$210.93\frac{3}{4}$, 2d Prem.
$\$22500 + \$28125 = \$50625$
$\$112500 - \$50625 = \$61875$
$\$61875 \times .00\frac{3}{5} = \$371.25$, 3d Prem.
$\$135. + \$210.93\frac{3}{4} + \$371.25 = \$717.18\frac{3}{4}$.

(9.) $75000 = \frac{2}{3}$ of 112500.
Hence each pays $\frac{2}{3}$ of the risk taken.
1st. $= \frac{2}{3}$ of $\$22500 = \$15000$.
2d. $= \frac{2}{3}$ of $\$28125 = \$18750$.
3d. $= \frac{2}{3}$ of $\$61875 = \$41250$.

(10.) $\$100000 \times .00\frac{3}{4} = \$750$
$\$60000 \times .00\frac{7}{8} = \$525$
$\$750 - \$525 = \$225$.

(11.) $\$3600)\$54.$
$.01\frac{1}{2} = 1\frac{1}{2}\%$

(15.) $123.90 \div 5000 = 2\frac{239}{500}\%$.

(16.) $60.75 \div .02\frac{1}{4} = 2700$. *Ans.*

(17.) $88.75 \div .02\frac{1}{2} = 3550$. *Ans.*

(18.) $378 \div .03 = 12600$. *Ans.*

(20.) $9700 \times \$1.20 = \$11640$
$100\% - 3\% = 97\% = \$11640$
$1\% = \frac{1}{97}$ of $\$11640 = \$120$
$100\% = 100 \times \$120 = \$12000$.

TAXES.

PAGE 211.

(1.) $\$2500 \times .01\frac{1}{2} = \$37.50$.

(2.) $\$1600 \times .023 = \$36.80$.
$\$36.80 + \$1 = \$37.80$.

(3.) $\$1500 + \$300 + \$50 + \$200 = \$2050$
$\$2050 \times .01\frac{3}{10} = \$26.65$.

(4.) $2500000\overline{)28000}$
$.01\frac{3}{25}$

(5.) $\$210000 \times .01\frac{4}{10} = \$2940$
$\$2940 - \$2750 = \$190$. *Ans.*

(6.) $\$3200 - \$140 = \$3060$
$3060 \div 180000 = .017$.

(7.) $\$33250 \div \$950000 = .03\frac{1}{2}$
$\$15370 \times .03\frac{1}{2} = \$537.95$.

(8.) $\$8960 \div \$64000 = .014$
$102.90 \div .014 = 7350$. *Ans.*

(9.) $\$6748950 \times .03\frac{6}{10} = \$242962.20$
$\$242962.20 \times .01\frac{1}{2} = \$3644.43 + =$ Fees.
$\$242962.20 - \$3644.43 = \$239317.77 =$ Am't coll'd.

(10.) \$2910 − \$276 = \$2634
2634 ÷ 175600 = .01½, Rate.
\$1200 + \$50 = \$1250
\$1250 × .01½ = \$18.75
\$18.75 + \$1 = \$19.75, B's tax.

CUSTOMS.

PAGE 213.

(2.) 60 × 48½ yd. = 2910 yd.
2910 × \$1.80 = \$5238
\$5238 × .30 = \$1571.40.

(3.) 25 × 24 × 45 yd. = 27000 yd.
27000 × \$1.13 = \$30510
\$30510 × .28 = \$8542.80.

(4.) 80 hhd. 20 gal. = 5060 gal.
5060 × \$.60 = \$3036
\$3036 × .12½ = \$379.50.

(5.) 1250 × \$2.75 = \$3437.50
1640 × \$2.05 = \$3362
1080 × \$1.85 = \$1998
\$3437.50 × .45 = \$1546.875, Duty on silk.
\$3362 + \$1998 = \$5360
\$5360 × .32 = \$1715.20, Duty on woolen.
\$1546.875 + \$1715.20 = \$3262.075.

(6.) 12 × 42 gal. = 504 gal.
504 × .05 = 25.20 gal., Leakage.
504 gal. − 25.20 gal. = 478.80 gal.
478.80 × \$1.30 = \$622.44
\$622.44 × .31½ = \$196.068.

(7.) $120 \times .12\frac{1}{2} = 15$
$120\text{ doz.} - 15\text{ doz.} = 105\text{ doz.}$
$105 \times \$23 = \$2415$
$\$2415 \times .22 = \$531.30.$

(8.) $540 \times 160\text{ lb.} = 86400\text{ lb.}$
$86400 \times .03\frac{1}{2} = 3024\text{ lb.}$
$86400\text{ lb.} - 3024\text{ lb.} = 83376\text{ lb.}$
$83376 \times 9\text{¢} = \$7503.84$
$\$7503.84 \times .15 = \$1125.576.$

(9.) $50 \times 220\text{ lb.} = 11000\text{ lb.}$
$11000\text{ lb.} \times .04 = 440\text{ lb.}$
$11000\text{ lb.} - 440\text{ lb.} = 10560\text{ lb.}$
$10560 \times 5\text{¢} = \$528$
$184.80 \div 528 = 35\%.$

(10.) $60 \times 54\text{ gal.} = 3240\text{ gal.}$
$3240 \times \$1.80 = \$5832$, Cost.
$3240\text{ gal.} \times .05 = 162\text{ gal.}$, Leakage.
$3240\text{ gal.} - 162\text{ gal.} = 3078\text{ gal.}$
$3078 \times \$1.80 = \$5540.40$
$\$5540.40 \times .20 = \$1108.08 =$ Duty.
$3240 \times 25\text{¢} = \$810$, Trans.

$$\begin{array}{rl} \$5832.00 & \text{Cost.} \\ 1108.08 & \text{Duty.} \\ 810.00 & \text{Trans.} \\ 8.50 & \text{Cartage.} \\ \hline \$7758.58. & \textit{Ans.} \end{array}$$

NOTE.—Transportation is paid on the whole amount shipped, but Duty is paid only on what remains after allowances are deducted.

(11.) 40×160 yd. $= 6400$ yd.
$20\% = \frac{1}{5} = \$1024$
$\frac{5}{5} = 5 \times \$1024 = \$5120$
$5120 \div 6400 = .80$. *Ans.*

CAPITAL AND STOCK.

PAGE 215.—*Oral Exercise.*

3. When stock is at 15% premium, one share is worth \$115, and 20 shares are worth 20 times \$115, or \$2300.

4. When stock is at a discount of 20%, one share is worth \$80, and 40 shares are worth 40 times \$80, or \$3200.

Written Problems.

(2.) $100\% - 27\% = 73\%$
$73\% + \frac{1}{8}\% = 73\frac{1}{8}\%$
$62 \times \$73\frac{1}{8} = \$4533.75$.

(3.) $85\frac{1}{4}\% + \frac{1}{8}\% = 85\frac{3}{8}\%$
$65 \times \$85\frac{3}{8} = \$5549\frac{3}{8}$.

(4.) $103\frac{3}{4}\% + \frac{1}{8}\% = 103\frac{7}{8}\%$
$75 \times \$103\frac{7}{8} = \$7790\frac{5}{8}$.

(5.) $63\frac{1}{4}\% + \frac{1}{8}\% = 63\frac{3}{8}\%$
$100 \times \$63\frac{3}{8} = \$6337.50$
$75\% - \frac{1}{8}\% = 74\frac{7}{8}\%$
$100 \times \$74\frac{7}{8} = \$7487.50$
$\$7487.50 - \$6337.50 = \$1150$.

CASE II.—PAGE 216.—*Oral.*

2. If I bought canal stock at par and sold it at 60%, I lost the difference between 100% and 60%, which is 40%, or $\frac{2}{5}$. If $\frac{2}{5}$ is \$200, $\frac{1}{5}$ is $\frac{1}{2}$ of \$200, or \$100, and $\frac{5}{5}$ is 5 times \$100, or \$500, which is the value of 5 shares.

Written Problems.

(1.) $\$107\frac{1}{4} - \$100 = \$7\frac{1}{4}$, Gain on 1 share.
$\$1740 \div \$7\frac{1}{4} = 240$. *Ans.*

(2.) $\$100 - \$76\frac{3}{4} = \$23\frac{1}{4}$, Loss per share.
$\$3720 \div \$23\frac{1}{4} = 160$. *Ans.*

(3.) $\$112\frac{1}{2} - \$96\frac{1}{4} = \$16\frac{1}{4}$, Gain per share.
$3556 \div 16\frac{1}{4} = 224$. *Ans.*

CASE III.—PAGE 217.—*Oral.*

2. 60 shares are worth $6000, and $4\frac{1}{2}\%$ of $6000 is $270.

3. If the semi-annual dividend is $3\frac{1}{2}\%$, the annual dividend is 2 times $3\frac{1}{2}\%$, or 7%. 24 shares are worth $2400, and 7% of $2400 is $168.

4. His assessment is 15% of $2500, or $375.

Written Problems.

(1.) $650 \times \$100 = \$65000$
$\$65000 \times .06\frac{3}{4} = \$4387.50$.

(2.) $250 \times \$100 = \$25000$
$\$25000 \times .12\frac{3}{4} = \$3187.50$.

(3.) $\$11040 \div \$115 = 96$
$96 \times \$100 = \$9600$, Par value.
$\$9600 \times .09 = \$864$.

(4.) $\$12731.25 \div \$72\frac{3}{4} = 175$
$175 \times \$100 = \$17500$, Par value.
$2\frac{1}{2}\% \times 4 = 10\%$ = annual dividend.
$.10 \times \$17500 = \$1750$ = Dividend.
$\$1750 \div \$12731.25 = 13\frac{217}{291}\%$, Profit.

CASE IV.—PAGE 218.—*Oral.*

3. 15%, or $\frac{3}{20}$, of his stock is \$375, etc.

4. If 3% is \$450, 1% is $\frac{1}{3}$ of \$450, or \$150, and 100%, or the stock, is 100 times \$150, or \$15000.

Written Problems.

(5.) $13\frac{3}{8}\% = \$428$
$1\% = 428 \div 13\frac{3}{8}$, or \$32
$100\% = 100 \times \$32 = \$3200.$

(6.) $12\frac{1}{2}\% = \frac{1}{8} = \$700$
$\frac{8}{8} = 8 \times \$700 = \$5600$
$\$5600 \div \$50 = 112.$

(7.) $2\frac{1}{4}\% = \$945$
$1\% = 945 \div 2\frac{1}{4} = \$420$
$100\% = 100 \times \$420 = \$42000$
$\$42000 = 420$ shares
$\$86\frac{1}{4} - \$73 = \$13\frac{1}{4}$
$420 \times \$13\frac{1}{4} = \$5565$
$\$5565 + \$945 = \$6510.$ *Ans.*

(8.) $82\% + 5\frac{1}{2}\% = 87\frac{1}{2}\%$
$87\frac{1}{2}\% - 65\% = 22\frac{1}{2}\%$, Gain on the par value.
$22\frac{1}{2}\% = \$1125$
$1\% = 1125 \div 22\frac{1}{2} = \$50$
$100\% = 100 \times \$50 = \$5000$
$\$5000 \div \$100 = 50.$ *Ans.*

CASE V.—*Oral.*

3. If \$5000 gain \$150, \$1 will gain $\frac{1}{5000}$ of \$150, or 3 cents; hence, the rate is 3 cents on the hundred, or 3%.

4. 20 shares of stock are worth \$2000, and for this sum to gain \$160 will require as many per cent. as \$2000 is contained times in \$160, which is $\frac{8}{100}$, or 8%.

PAGE 219.—*Written Problems.*

(5.) 250 sh. = $25000
2 × $1125 = $2250, Annual dividend.
2250 ÷ 25000 = .04½, or 4½%.

(6.) 26500 ÷ 500000 = 5% +
5% of $500000 = $25000
$26500 – $25000 = $1500, Surplus.

(7.) $265000 – $15000 = $250000
$250000 ÷ $2000000 = .12½, or 12½%.

(8.) $12500 + $12000 = $24500
$86500 – $24500 = $62000
62000 ÷ 400000 = .15½, or 15½%.

CASE VI.—*Oral.*

3. When stock is at 20% discount, the value is 80%. 80% of $25 is $20; hence, as many shares can be bought as 20 is contained times in 1640, or 82 shares.

4. When stock is 12% above par, $1 worth of stock sells at $1.12, and $50 worth sells at 50 times $1.12, or $56. As many shares can be bought for $8400 as 56 is contained times in 8400, or 150 shares.

Written Problems.

(5.) 4¾% = $4¾ per share.
$100 + $4¾ = $104¾
$12570 ÷ $104¾ = 120. *Ans.*

(6.) 13125 ÷ .87½ = 15000, Stock.
91% – 87½% = 3½%
3½% of $15000 = $525, Gain.

PAGE 220.

(7.) $3\frac{1}{2}\% + 2\frac{1}{4}\% = 5\frac{3}{4}\% = \frac{23}{4}\% = \$258.75$
$\frac{1}{4}\% = \frac{1}{23}$ of $\$258.75 = \$11.25$
$1\% = 4 \times \$11.25 = \$45$
$100\% = 100 \times \$45 = \$4500.$

(8.) $111\frac{1}{2}\% + 5\frac{1}{2}\% = 117\%$
$117\% - 113\% = 4\%$
$\$9040 \div 1.13 = \$8000$, Stock.
4% of $\$8000 = \$320$, Gain.

GOLD AND CURRENCY.

PAGE 220.—*Oral.*

5. When gold is at a premium of 12%, $1 in gold is worth $1.12 in currency, and as much gold can be bought for $560 as $1.12 is contained times in $560, or $500.

6. When gold is at 8% premium, as much gold can be bought for $1080 as $1.08 is contained times in $1080, or $1000.

Written Problems.

(7.) $\$2740 \times \$1.11\frac{3}{8} = 3051.675.$ *Ans.*

(8.) $\$6500 \times \$1.13\frac{7}{8} = 7401.87\frac{1}{2}.$ *Ans.*

(9.) $\$4850 \times \$1.16\frac{1}{4} = 5638.12\frac{1}{2}.$ *Ans.*

(10.) $\$1 \div \$1.13 = .88\frac{56}{113}.$ *Ans.*

(11.) $\$220 \div \$1.75 = 125.71\frac{3}{7}.$ *Ans.*

(12.) $\$7695 \div \$1.12\frac{1}{2} = 6840.$ *Ans.*

INTEREST.

PAGE 223.—*Oral.*

20. 12 days equals $\frac{12}{30}$, or $\frac{2}{5}$, of a month; hence, 2 months and 12 days equal $2\frac{2}{5}$ mo., or $\frac{12}{5}$ mo. $\frac{1}{5}$ of a month equals $\frac{1}{5}$ of $\frac{1}{12}$, or $\frac{1}{60}$, of a year, and $\frac{12}{5}$ mo. equals $\frac{12}{60}$, or $\frac{1}{5}$, of a year; hence, 6 yr. 2 mo. 12 d. equal $6\frac{1}{5}$ years. The interest for 1 year is 6% of $300, or $18, and for $6\frac{1}{5}$ years it is $6\frac{1}{5}$ times $18, or $$111\frac{3}{5}$.

21. *Sug.* 6 d. = $\frac{1}{5}$ mo.; 7 mo. 6 d. = $7\frac{1}{5}$ mo., or $\frac{36}{5}$ mo., which equals $\frac{36}{5}$ of $\frac{1}{12}$ yr. = $\frac{3}{5}$ yr.; 3 yr. 7 mo. 6 d. = $3\frac{3}{5}$ yr. The interest for 1 yr. at 5% is $13.50, and for $3\frac{3}{5}$ yr. it is $3\frac{3}{5}$ times $13.50, or $48.60.

22. *Sug.* 24 d. = $\frac{4}{5}$ of a mo., or $\frac{4}{5}$ of $\frac{1}{12}$ yr. = $\frac{1}{15}$ yr.; hence, 3 yr. 24 d. = $3\frac{1}{15}$ yr. If the interest for 1 yr. is 15%, for $3\frac{1}{15}$ yr. it is $3\frac{1}{15}$ times 15%, or 46%; 46% of $300 is $138.

23. *Sug.* 20 d. = $\frac{2}{3}$ mo.; hence, 6 mo. 20 d. = $6\frac{2}{3}$ mo., or $\frac{20}{3}$ mo. $\frac{20}{3}$ mo. = $\frac{20}{3}$ of $\frac{1}{12}$ yr. = $\frac{4}{9}$ yr.; hence, 1 yr. 6 mo. 20 d. = $1\frac{4}{9}$ yr., or $\frac{13}{9}$ yr. If the interest is 9% a year, for $\frac{13}{9}$ yr. it is $\frac{13}{9} \times 9\% = 13\%$; 13% of $600 = $780.

24. *Sug.* 6 d. = $\frac{1}{5}$ mo.; hence, 1 mo. 6 d = $1\frac{1}{5}$ mo., or $\frac{6}{5}$ mo. = $\frac{6}{5} \times \frac{1}{12}$ yr, or $\frac{1}{10}$ yr.; hence, 1 yr. 1 mo. 6 d. = $1\frac{1}{10}$ yr; 10% of $250 = $25. If the interest is $25 for 1 yr., for $1\frac{1}{10}$ yr. it is $1\frac{1}{10}$ times $25 = $27.50.

Written Problems.

(5.) 3 yr. 7 mo. = $3\frac{7}{12}$ yr.
.08 × $315 = $25.20
$3\frac{7}{12}$ × $25.20 = $90.30, Int.
$315 + $90.30 = $405.30, Amt.

(6.) 2 yr. 3 mo. 12 d. = $2\frac{17}{60}$ yr.
.06 × $625 = $37.50
$2\frac{17}{60}$ × $37.50 = $$85.62\frac{1}{2}$.

(7.) 30)18 d.
12)6.6 mo.
5.55 yr.
.05 × \$126 = \$6.30
5.55 × \$6.30 = \$34.965.

(8.) 30)4 d.
12)4.1333+
4.3444+
.04 × \$1785 = \$71.40
4.3444 × \$71.40 = \$310.19, Int.
\$1785 + \$310.19 = \$2095.19, Amt.

(9.) 30)3 d.
12)3.1 mo.
$3.2\frac{7}{12}$ yr.
$.06\frac{1}{2} \times \$640.20 = \$41.613$
$3.2\frac{7}{12} \times \$41.613 = \$135.59$. *Ans.*

Page 225.

(3.) 9 yr. 5 mo. = 113 m.
$\frac{1}{2}$ of 113 = $56\frac{1}{2}$ = \$.565
725 × \$.565 = \$409.625
6)409.625
$\$68.270\frac{5}{6}$, Int. at 1%.
5
$\$341.354\frac{1}{6}$, Int. at 5%.

(4.) 6 yr. 3 mo. = 75 mo.
$\frac{1}{2}$ of 75 = $37\frac{1}{2}$ = .\$375
650.30 × \$.375 = \$243.8625
6)243.8625
$\$40.6437\frac{1}{2}$, Int. at 1%.
8
\$325.1500, Int. at 8%.

(5.) 3 yr. 9 mo. = 45 mo.
$\frac{1}{2}$ of 45 = $22\frac{1}{2}$, or $22\frac{1}{2}$¢
720.50 × $22\frac{1}{2}$¢ = \$162.1125
6)162.1125
\$27.0187 +, Int. at 1%.
10
\$270.187, Int. at 10%.
720.50
\$990.687, Amt.

(6.) 2 yr. 8 mo. = 32 mo.
$\frac{1}{2}$ of 32 = 16 = \$.16
$\frac{1}{6}$ of 12 = 2 = .002
\$.162
85 × \$.162 = \$13.77, Int.
\$85 + \$13.77 = \$98.77, Amt.

(7.) 3 yr. 7 mo. = 43 mo.
$\frac{1}{2}$ of 43 = $21\frac{1}{2}$ = \$.215
$\frac{1}{6}$ of 15 = $2\frac{1}{2}$ = .0025
\$.2175
1250 × \$.2175 = \$271.875
6)271.875
\$45.3125, Int. at 1%.
8
\$362.50, Int. at 8%.
\$1250 + \$362.50 = \$1612.50, Amt.

	yr.	mo.	d.
(8.)	1877	6	13
	1876	5	8
	1 yr. 1 mo. 5 d.		

1 yr. 1 mo. = 13 mo.
$\frac{1}{2}$ of 13 = $6\frac{1}{2}$ = \$.065
$\frac{1}{6}$ of 5 d. = $\frac{5}{6}$ = $.000\frac{5}{6}$
\$$.065\frac{5}{6}$
550 × \$$.065\frac{5}{6}$ = \$36.208 +.

	yr.	mo.	d.
(9.)	1875	3	28
	1873	8	16
	1 yr.	7 mo.	12 d.

1 yr. 7 mo. = 19 mo.

$\frac{1}{2}$ of $19 = 9\frac{1}{2} = \$.095$

$\frac{1}{6}$ of $12 = 2 = .002$

$\$.097$

$1116 \times \$.097 = \$108.252$

$\frac{1}{6}$ of $\$108.252 = \$18.042$, Int. at 1%.

$7 \times \$18.042 = \$126.294$, Int. at 7%.

	yr.	mo.	d.
(10.)	1878	3	16
	1876	9	25
	1 yr.	5 mo.	21 d.

1 yr. 5 mo. = 17 mo.

$\frac{1}{2}$ of $17 = 8\frac{1}{2} = \$.085$

$\frac{1}{6}$ of $21 = 3\frac{1}{2} = .0035$

$\$.0885$

$125.40 \times \$.0885 = \$11.0979$, Int.

$\$125.40 + \$11.0979 = \$136.4979$, Amt.

METHOD BY ALIQUOT PARTS.

(2.) $\$620 \times .06 = \$37.20$, Int. for 1 yr.
$\$37.20 \times 6 = \$223.20$, Int. for 6 yr.
$\frac{1}{12}$ of $\$223.20 = 18.60$, " " 6 mo.
$\frac{1}{3}$ of $\$18.60 = 6.20$, " " 2 mo.
$\$248.00$

(3.) $\$800 \times .07 = \$56$, Int. for 1 yr.
$\$56 \times 3 = \$168$ = Int. for 3 yr.
$\frac{1}{12}$ of $\$168 = 14$ = " " 3 mo.
$\frac{1}{6}$ of $\$14 = 2.33$ = " " 15 d.
$\$184.33$

$$\begin{array}{llll}
(4.) & \$660 \times .09 = & \$59.40, & \text{Int. for 1 yr.} \\
& 2 \times \$59.40 = & \$118.80, & \text{Int. for 2 yr.} \\
& \frac{1}{12} \text{ of } \$118.80 = & 9.90, & \text{`` `` 2 mo.} \\
& \frac{1}{30} \text{ of } \$9.90 = & \underline{.33,} & \text{`` `` 2 d.} \\
& & \$129.03. &
\end{array}$$

$$\begin{array}{llll}
(5.) & \$300 \times .10 = & \$30, & \text{Int. for 1 yr.} \\
& \frac{1}{12} \text{ of } \$30 = & 2.50 & \text{`` 1 mo.} \\
& \frac{1}{30} \text{ of } \$2.50 = & \underline{.08} & \text{`` 1 d.} \\
& & \$32.58 &
\end{array}$$

METHOD BY DAYS.—PAGE 226.

(3.) $\frac{76 \times 30}{60} = \$.38.$

(4.) $\frac{1254 \times 25}{60} = \$5.22\frac{1}{2}.$

(5.) $\frac{96.50 \times 36}{60} = \$.579.$

(6.) $\frac{117.35 \times 48}{60} = \$.9388.$

(7.) $\frac{60 \times 40 \times 7}{360} = \$.46\frac{2}{3}.$

(8.) $\frac{125 \times 54 \times 8}{360} = \$1.50.$

(9.) $\frac{1215 \times 18 \times 5\frac{1}{2}}{360} = \$3.34.$

(10.) $\frac{37.50 \times 26 \times 8}{360} = \$.21\frac{2}{3}.$

(11.) $\frac{87.75 \times 50 \times 10}{360} = \$1.22.$

(12.) $\frac{118.63 \times 45 \times 7}{360} = \$1.038+.$

(13.) $\frac{78.45 \times 36}{60} = \$.47+.$

(14.) $\frac{1260.60 \times 134 \times 7}{360} = \$47.55+.$

PROBLEMS IN INTEREST.

CASE I.—PAGE 228.—*Oral Exercise.*

11. The interest is the difference between \$287.50 and \$250, which is \$37.50. The interest on \$250 for 3 yr. at 1% is \$7.50. To gain \$37.50 will therefore require as many per cent. as \$7.50 is contained times in \$37.50, or 5%.

REMARK.—The 12th is solved in a similar manner.

13. The interest is the difference between \$224 and \$175, or \$49. The interest on \$175 for 3 yr. at 1% is \$5.25, and for 6 mos., or half a year, it is 87½ cents; hence for 3 yr. 6mo. it is \$5.25 plus 87½ cents, or \$6.12½. If the interest at 1% is \$6.12½ for the given time, to gain \$49 interest will require as many per cent. as \$6.12½ is contained times in \$49, or 8%.

REMARK.—The 14th is solved in a similar manner.

15. A principal, to double itself, must gain once itself, or 100%. It gains at 1% in 2 years 2% of itself; hence, to gain 100% in 2 yr. will require as many per cent. as 2 is contained times in 100, or 50%.

16. A principal, to treble itself, must gain twice itself, or 200%. It gains 10% of itself in 10 years at 1%, and to gain 200% in the same time will require as many per cent. as 10 is contained times in 200, or 20%.

17. To quadruple itself, a principal must gain 300% of itself. It gains 5% of itself in 5 years at 1%; hence, to gain 300% will require as many per cent. as 5 is contained times in 300, or 60%.

18. The interest on \$6.50 for 3 yr. 6 mo. at 1% is \$22.75; hence \$159.25 is the interest for the same time at as many per cent. as \$22.75 is contained times in \$159.25, or 7%.

Written Problems.

(2.) 6 yr. 3 mo. = $6\frac{1}{4}$ yr.
$.06\frac{1}{4} \times \$1255 = \$78.43\frac{3}{4}$
$\$313.75 \div \$78.43\frac{3}{4} = 4.$ *Ans.*

(3.) 2 yr. 4 mo. = $2\frac{1}{3}$ yr.
$\$125.50 \times .02\frac{1}{3} = \$2.92\frac{5}{6}$
$\$17.57 \div \$2.92\frac{5}{6} = 6.$ *Ans.*

	yr.	mo.	d.
(4.)	1875	1	27
	1873	3	12

1 yr. 10 mo. 15 d. = $1\frac{7}{8}$ yr.
$\$640 \times .01\frac{7}{8} = \$12$
$60 \div 12 = 5.$ *Ans.*

(5.) 12 yr. 6 mo. = $12\frac{1}{2}$ yr.
$\$300 - \$150 = \$150$
$\$150 \times .12\frac{1}{2} = \$18.75$
$\$150 \div \$18.75 = 8.$ *Ans.*

(6.) $\$275 \div \$4000 = .06\frac{7}{8}.$ *Ans.*

(7.) $12 \times \$10 = \$120$, Annual rent.
$\$120 \div \$1800 = .06\frac{2}{3}.$ *Ans.*

(8.) $12 \times \$9 = \$108$
$\$108 - \$36 = \$72$
$\$72 \div \$1600 = .04\frac{1}{2}.$ *Ans.*

(9.) $12 \times \$150 = \$1800$
$\$1800 \div \$15000 = 12\%$, Business income.
$\$2300 \div \$20000 = 11\frac{1}{2}\%$, House "
$12\% - 11\frac{1}{2}\% = \frac{1}{2}\%.$ *Ans.*

(10.) 7 yr. − 4 yr. = 3 yr.
$8100 − $7200 = $900, Dif. of int.
⅓ of $900 = $300, Int. for 1 yr.
4 × $300 = $1200, " 4 yr.
$7200 − $1200 = $6000 = Prin.
$6000 × .01 = $60, Int. at 1% for 1 yr.
$300 ÷ $60 = 5, or 5%. *Ans.*

(11.) 9 yr. 3 mo − 6 yr. 6 mo. = 2¾ yr.
$8896.50 − $7857 = $1039.50, Dif. of int.
$1039.50 ÷ 2¾ = $378, Int. for 1 yr.
6½ × $378 = $2457, Int. for 6 yr. 6 mo.
$7857 − $2457 = $5400, Prin.
$5400 × .01 = $54, Int. at 1%
378 ÷ 54 = 7, or 7%. *Ans.*

Case II.—Page 230.—*Oral Exercise.*

10. To double itself, a principal must gain 100% of itself; hence, at 5% it will require as many years as 5 is contained times in 100, or 20 years.

11. To treble itself, a principal must gain twice itself, or 200%; hence, to treble itself at 10% will require as many years as 10 is contained times in 200, or 20 years.

12. To quadruple itself, a principal must gain 300%; hence, to quadruple itself at 5% will require as many years as 5 is contained times in 300, or 60 years.

13. The difference between 7% and 5% is 2%. The difference between $710 and $650 is $60, which is the interest at 2%; the interest at 1% is ½ of $60, or $30, and at 5% it is 5 times $30, or $150; hence, the principal is the difference between $650 and $150, or $500. $500 in 1 year at 5% will gain $25, and to gain $150 will require as many years as 25 is contained times in 150, or 6 years.

14. The difference between 8% and 6% is 2%. The difference between \$5720 and \$4840 is \$880, which is 2% of the principal. 1% is ½ of \$880, or \$440, and 6% is 6 times \$440, or \$2640; hence the principal is \$4840 minus \$2640, or \$2200. The interest on \$2200 for 1 year at 6% is \$132; hence, to gain \$2640 will require as many years as 132 is contained times in 2640, or 20 years.

15. The difference between 9% and 6% is 3%; the difference between \$23200 and \$20800 is \$2400, which is the difference of interest at 3%. If 3% is \$2400, 1% is ⅓ of \$2400, or \$800, and 6% is 6 times \$800, or \$4800. The principal is \$20800 less \$4800, or \$16000. The interest on \$16000 for 1 year at 6% is \$960; hence, to gain \$4800 will require as many years as \$960 is contained times in \$4800, or 5 years.

PAGE 231.—*Written Problems.*

(2.) \$1250 × .05 = \$62.50
218.75 ÷ 62.50 = $3\frac{1}{2}$. *Ans.*

(3.) \$127.30 × .06 = \$7.638
$31.81\frac{1}{2} \div 7.638 = 4\frac{1}{6}$, or 4 yr. 2 mo.

(4.) \$127 × .12 = \$15.24
99.06 ÷ 15.24 = $6\frac{1}{2}$, or 6 yr. 6 mo.

(5.) \$180 × .06 = \$10.80
196.47 − 180 = 16.47
16.47 ÷ 10.80 = $1\frac{21}{40}$ = 1 yr. 6 mo. 9 d.

yr.	mo.	d.
1866	5	1
1	6	9
1867	11	10 = Nov. 10, 1867.

(6.) $\$600 - \$500 = \$100$
$\$500 \times .06 = \$30$
$100 \div 30 = 3\frac{1}{3}$, or 3 yr. 4 mo.

$$\begin{array}{rrr} \text{yr.} & \text{mo.} & \text{d.} \\ 1867 & 6 & 10 \\ 3 & 4 & \\ \hline 1870 & 10 & 10 \end{array} = \text{Oct. } 10, 1870.$$

(7.) $\$140 \times .06 = \$8.40$
$28.28 \div 8.40 = 3\frac{77}{210} = 3$ yr. 4 mo. 12 d.

(8.) $\$126 \times .05 = \$6.30$
$\$161.28 - \$126 = \$35.28$
$35.28 \div 6.30 = 5\frac{21}{35}$.
$5\frac{21}{35}$ yr. = 5 yr. 7 mo. 6 d.

(9.) $\$260 \times .04\frac{3}{4} = \$12.35$
$39.52 \div 12.35 = 3\frac{1}{5}$ yr.

(10.) Prin. = 100%
$100\% \div 6\% = 16\frac{2}{3}$
$16\frac{2}{3}$ yr. = 16 yr. 8 mo.
etc.

(11.) $10\% - 7\% = 3\%$
$\$795 - \$736.50 = \$58.50$
$3\% = \$58.50$
$1\% = \frac{1}{3}$ of $\$58.50 = \$19.50$
$10\% = 10 \times \$19.50 = \$195$
$\$795 - \$195 = \$600$
\$600 @ 10% = \$60
$195 \div 60 = 3\frac{1}{4}$, or $3\frac{1}{4}$ yr.

CASE III.—PAGE 232.—*Oral Exercise.*

7. *Sug.* 2 yr. 6 mo. = $2\frac{1}{2}$ yr. Interest on \$1 for $2\frac{1}{2}$ yr. at 6% = 15¢; hence the interest = $\frac{15}{100}$, or $\frac{3}{20}$, of the prin-

cipal. $\frac{3}{20}=\$240$; $\frac{1}{20}=\frac{1}{3}$ of \$240, or \$80; and $\frac{20}{20}=20\times\$80=\$1600$.

8. 2 years and 9 months equal $2\frac{3}{4}$ years. The interest of \$1 for $2\frac{3}{4}$ years at 8% is 22 cents; hence the interest is $\frac{22}{100}$, or $\frac{11}{50}$, of the principal. $\frac{50}{50}$, or the principal, plus $\frac{11}{50}$ of the principal, equals $\frac{61}{50}$ of the principal, or \$14640. $\frac{1}{50}$ of the principal is $\frac{1}{61}$ of \$14640, which is \$240, and $\frac{50}{50}$, or the principal, is 50 times \$240, or \$12000.

9. 5 years and 6 months equal $5\frac{1}{2}$ years. The interest on \$1 at 10% for $5\frac{1}{2}$ years is 55 cents; hence $\frac{55}{100}$, or $\frac{11}{20}$, of the principal equals the interest. $\frac{20}{20}$, or the principal, plus $\frac{11}{20}$ of the principal, equals $\frac{31}{20}$ of the principal, or the amount, which is \$3875. $\frac{1}{20}$ equals $\frac{1}{31}$ of \$3875, which is \$125, and $\frac{20}{20}$ is 20 times \$125, or \$2500.

10. The interest on \$1 for 6 years at 6% is 36 cents; hence $\frac{36}{100}$, or $\frac{9}{25}$, of the principal equals the interest. If \$2700 is $\frac{9}{25}$ of the principal, $\frac{1}{25}$ is $\frac{1}{9}$ of \$2700, or \$300, and $\frac{25}{25}$, or the principal, is 25 times \$300, which is \$7500. If A's money equals twice B's, $\frac{2}{3}$ A's is equal to $\frac{2}{3}$ of twice B's, or $\frac{4}{3}$ B's. $\frac{4}{3}$ B's plus $\frac{3}{4}$ B's equals $\frac{25}{12}$ B's, which equals \$7500; $\frac{1}{12}$ B's equals $\frac{1}{25}$ of \$7500, which is \$300, and $\frac{12}{12}$, or B's, equals 12 times \$300, or \$3600. A's is twice \$3600, or \$7200.

PAGE 233.—*Written Problems.*

(3.) $21\times 6\%=126\%$
$100\%+126\%=226\%=\$1130$
$1\%=\frac{1}{226}$ of $\$1130=\$5$
$100\%=100\times\$5=\$500$. *Ans.*

(4.) $2\times\$245=\$490=7\%$
$1\%=\frac{1}{7}$ of $\$490=\$70$
$100\%=100\times\$70=\$7000$. *Ans.*

(5.) 7 yr. 7 mo. 6 d. = $7\frac{3}{5}$ yr.
$7\frac{3}{5} \times 5\% = 38\% = \$2356$
$1\% = \frac{1}{38}$ of $\$2356 = \$62$
$100\% = 100 \times \$62 = \$6200$.

(6.) 5 yr. 4 mo. = $5\frac{1}{3}$ yr.
$5\frac{1}{3} \times 7\% = 37\frac{1}{3}\%$
$100\% + 37\frac{1}{3}\% = 137\frac{1}{3}\% = \frac{412}{3}\%$
$\frac{1}{3}\% = \frac{1}{412}$ of $\$2101.20 = \$5.10$
$\frac{3}{3}\% = 3 \times \$5.10 = \$15.30$
$100\% = 100 \times \$15.30 = \$1530$.

(7.) 6 yr. 6 mo. = $6\frac{1}{2}$ yr.
$6\frac{1}{2} \times 6\% = 39\% = \$3198$
$1\% = \frac{1}{39}$ of $\$3198 = \$82$
$100\% = 100 \times \$82 = \$8200$
B's = $\frac{4}{5}$ A's
$\frac{2}{3}$ B's = $\frac{2}{3} \times \frac{4}{5}$ A's = $\frac{8}{15}$ A's
$\frac{5}{6}$ A's + $\frac{8}{15}$ A's = $\frac{41}{30}$ A's = \$8200
$\frac{1}{30}$ A's = $\frac{1}{41}$ of \$8200 = \$200
A's = 30 × \$200 = \$6000
B's = $\frac{4}{5}$ of \$6000 = \$4800.

(8.) 3 yr. 4 mo. 15 d. = $3\frac{3}{8}$ yr.
$3\frac{3}{8} \times 8\% = 27\% = \$7290$
$1\% = \frac{1}{27}$ of $\$7290 = \$270$
$100\% = 100 \times \$270 = \$27000$
Store = 2 Hotel.
F. = 3 " = 6 "
H. = 1 "
9 H. = \$27000
H. = $\frac{1}{9}$ of \$27000 = \$3000
S. = 2 × \$3000 = \$6000
F. = 3 × \$6000 = \$18000.

COMPOUND INTEREST.

PAGE 233.—*Oral Exercise.*

4. The interest on $1000 for 1 year at 5% is $50, which, added to the principal, equals $1050, the new principal. The interest on $1050 for 1 year at 5% is $52.50, which, added to the new principal, $1050, equals $1102.50. The interest on $1102.50 for 1 year at 5% equals $55.125, which, added to the principal, $1102.50, equals $1157.625, the amount. The amount, $1157.625, less the principal $1000, equals $157.62½, the compound interest of $1000 for 3 years at 5%.

Written Problems.

(2.)

$620	Principal.
.05	
31.	Int. on $620 for 1 yr.
620.	
651.	Principal 2d yr.
.05	
32.55	Int. for 2d yr.
651	
683.55	Prin. for 3d yr.
.05	
34.1775	Int. for 3d yr.
683.55	
717.7275	Amount.
620	
$97.7275	Comp. int.

(3.)

$125	Principal.
.06	
7.50	Int. for 1 yr.
125.	
132.50	Prin. for 2d yr.
.06	
7.95	Int. for 2d yr.
132.50	
140.45	Prin. for 3d yr.
.06	
8.427	Int. for 3d yr.
140.45	
148.877	Amount.
125.	
$23.877	Comp. int.

(4.)

75.40	prin.
.06	
4.524	1st. int.
75.40	
79.924	2d prin.
.06	
4.79544	2d int.
79.924	
84.71944	3d prin.
.06	
5.0831664	3d int.
84.71944	
89.8026064	4th prin.
.06	
5.388156384	4th int.
89.8026064	
95.19	Amt.
75.40	
$19.79	Comp. int.

(5.)

80.50	prin.
.08	
6.44	1st int.
80.50	
86.94	2d prin.
.08	
6.9552	2d int.
86.94	
93.8952	3d prin.
.08	
7.511616	3d int.
93.8952	
101.406816	4th prin.
.04	
4.05627264	Int. for ½ yr.
101.406816	
105.463	Amt.
80.50	
$24.963	Comp. int.

(6.)

$$\begin{array}{rl}
\$190 & \text{prin.}\\
.03 & \\ \hline
5.70 & \text{1st int.}\\
190. & \\ \hline
195.70 & \text{2d prin.}\\
.03 & \\ \hline
5.8710 & \text{2d int.}\\
195.70 & \\ \hline
201.571 & \text{3d prin.}\\
.03 & \\ \hline
6.04713 & \text{3d int.}\\
201.571 & \\ \hline
207.61813 & \text{4th prin.}\\
.03 & \\ \hline
6.2285439 & \text{4th int.}\\
207.6181 & \\ \hline
213.847 & \text{Amount.}\\
190. & \\ \hline
\$23.847 & \text{Comp. int.}
\end{array}$$

(8.) $1.8009, amt. of $1 for 15 yr. @ 4%
1850 × $1.8009 = $3331.66½
$3331.66½ − $1850 = $1481.66½. *Ans.*

(9.) 21 yr. − 3 yr. = 18 yr.
$2.4066, amt. of $1 for 18 yr. @ 5%
3750 × $2.4066 = $9024.75. *Ans.*

(10.) 10 yr. 3 mo. 6 d. = $10\frac{4}{15}$ yr.
18 yr. − $10\frac{4}{15}$ yr. = $7\frac{11}{15}$ yr.
= 15 semi-annual payments, and int. for $\frac{7}{30}$ yr.
$1.5580, amt. of $1 for 15 yr. @ 3%
5000 × $1.5580 = $7790, amt. for 7½ yr.
$\frac{7}{30}$ of 6% = $1\frac{2}{5}$%
$1\frac{2}{5}$% of $7790 = $109.06, int. for $\frac{7}{30}$ yr.
$7790 + $109.06 = $7899.06, comp. amt.

ANNUAL INTEREST.

PAGE 237.

(2.) Int. on $660 for 1 yr. @ 5% = $33.
Int. on $660 for 4 yr. @ 5% = $132.
" " $33 for 6 yr. (3+2+1) @ 5% = 9.90
Annual int. = $141.90
Principal = 660.
Amount = $801.90

(3.) Int. of $4500 for 1 yr. at 6% = $270.
Int. of $4500 for 12 yr. @ 6% = $3240.
" " $270 for *66 yr. @ 6% = 1069.20
Annual int. = $4309.20
Principal = 4500.
Amount = $8809.20

(4.) Int. of $1800 for 1 yr. @ 7% = $126.
Int. of $1800 for 7 yr. @ 7% = $882.
" " $126 for 21 yr. @ 7% = 185.22
Annual int. = $1067.22
Principal = 1800.
Amount = $2867.22

(5.) Int. of $1550 for 1 yr. @ 6% = $93.
Int. of $1550 for 6 yr. @ 6% = $558.
" " $93 for 15 yr. @ 6% = 83.70
Annual int. = $641.70

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* $66 = \frac{12 \times 11}{2}$, or $11+10+9+8+7+6+5+4+3+2+1$.

(6.) 10 yr. 6 mo. 24 d. = $10\frac{17}{30}$ yr.

Int. on $600 for 1 yr. @ 6% = $36.

Int. on $600 for $10\frac{17}{30}$ yr. @ 6% = $380.40

" " $36 for *$50\frac{2}{3}$ yr. @ 6% = 109.44

Annual int. = $489.84

Principal = 600.

Amount = $1089.84.

PARTIAL PAYMENTS.

PAGE 241.

(2.)

		yr.	mo.	d.
Principal,	$650.			
Int. to Jan. 1, 1873,	14.62½	1873	1	1
Amount,	$664.62½	1872	8	16
Payment,	100.		4	15
Balance =	$564.62½			
Int. on Bal. to Apr. 1, 1873,	8.47	1873	4	1
Amount,	$573.09	1873	1	1
Payment,	20.		3	0
Balance =	$553.09			
Int. on Bal. to Aug. 25, 1874,	46.46	1874	8	25
Amount,	$599.55	1873	4	1
Payment,	300.	1	4	24
Balance =	$299.55	1875	1	1
Int. on Bal. to Jan. 1, 1875,	6.29	1874	8	25
Amount,	$305.84		4	6

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* $50\frac{2}{3} = 9\frac{17}{30} + 8\frac{17}{30} + 7\frac{17}{30} +$, etc. . . . . . $+ \frac{17}{30}$.

(3.)

		yr.	mo.	d.
Principal,	$540.			
Int. to Jan. 22, 1873,	11.88	1873	1	22
Amount,	$551.88	1872	9	10
Payment,	120.		4	12
Balance,	$431.88	1874	3	1
Int. to Mar. 1, 1874 = $28.72.		1873	1	22
Int. to Oct. 22, 1875,	45.35	1	1	9
Amount,	$477.23	1874	10	22
2d Payment, $25.00		1873	1	22
3d " 125.00	150.00	1	9	0
Balance,	$327.23	1875	7	16
Int. to July 16, 1875,	14.40	1874	10	22
Amount,	$341.63		8	24

(4.)

		yr.	mo.	d.
Principal,	$540.			
Int. to Jan. 1, 1866, @ 7%,	20.58	1866	1	1
Amount,	$560.58	1865	6	15
Payment,	25.		6	16
Balance,	$535.58	1867	9	16
Int. on Bal. to Sept. 16, 1867,	64.05	1866	1	1
Amount,	$599.63	1	8	15
Payment,	120.	1868	3	4
Balance,	$479.63	1867	9	16
Int. to Mar. 4, 1868, $15.67.			5	18
Int. to July 4, 1868,	26.86			
Amount,	$506.49	1868	7	4
3d Payment $10.00		1867	9	16
4th " 300.00	310.00		9	18
Balance,	$196.49	1869	8	16
Int. on. Bal. to Aug. 16, 1869,	15.36	1868	7	4
Amount,	$211.85	1	1	12

(5.)

		yr.	mo.	d.
Principal,	$850.			
Int. to Jan. 4, 1872,	21.68	1872	1	4
Amount,	$871.68	1871	8	1
Payment,	25.00		5	3
Balance,	$846.68	1873	5	1
Int. on Bal. to May 1, 1873,	67.31	1872	1	4
Amount,	$913.99	1	3	27
Payment,	250.00			
Balance,	$663.99	1874	7	10
Int. on Bal. to July 10, 1874,	47.48	1873	5	1
Amount,	$711.47	1	2	9
Payment,	250.00	1875	9	16
	$461.47	1874	7	10
Int. on Bal. to Sept. 16, 1875, $32.76.		1	2	6
Int. on Bal. to Dec. 1, 1875,	38.53	1875	12	1
Amount,	$500.00	1874	7	10
4th Payment, $20.00		1	4	21
5th " 400.00	420.00			
Balance,	$80.00	1876	7	4
Int. on Bal. to July 4, 1876,	2.84	1875	12	1
Amount,	$82.84		7	3

MERCANTILE RULE.

PAGE 242.

(2.)

Amount of—

$600	from June 10, 1875, to Jan. 1, 1876	(205 d.),		$620.50
$200	" Aug. 12, 1875, to " "	(142 d.),	$204.73	
$200	" Sept. 15, 1875, to " "	(108 d.),	203.60	
$200	" Dec. 1, 1875, to " "	(31 d.),	201.03	609.36
			Balance,	$11.14

Amount of— (3.)

$1000 from July 4, 1876, to Feb. 1, 1877 (212 d.),		$1035.33
$350 " Aug. 12, 1876, to " " (173 d.),	$360.09	
$350 " Oct. 9, 1876, to " " (115 d.),	356.71	
$250 " Jan. 1, 1877, to " " (31 d.),	251.29	968.09
	Balance,	$67.24

Amount of— (4.)

$325 from Aug. 10, 1873, to Ap. 1, 1874, @ 7 % (234 d.),		$339.79
$100 " Sept. 3, 1873, to " " " (210 d.),	$104.08	
$100 " Nov. 1, 1873, to " " " (151 d.),	102.93	
$100 " Jan. 1, 1874, to " " " (90 d.),	101.75	308.76
	Balance,	$31.03

Amount of— (5.)

$650 from June 26, 1877, to May 1, 1878, @ 8 % (309 d.),		$694.63
$220 " Oct. 20, 1877, to " " " (193 d.),	$229.43	
$200 " Jan. 8, 1878, to " " " (113 d.),	205.02	
$100 " Mar. 28, 1878, to " " " (34 d.),	100.76	
$110 " Apr. 16, 1878, to " " " (15 d.),	110.38	645.59
	Balance,	$49.04

COMMERCIAL DISCOUNT.

PAGE 243.

(2.) 20% of $3.75 = $.75
$3.75 − $.75 = $3. *Ans.*

(3.) 8% of $650 = $52. *Ans.*

(4.) 6% of $8 = $.48
$8 − $.48 = $7.52. *Ans.*

(5.) $2\frac{1}{2}$% of $1580 = $39.50. *Ans.*

(6.) 6 × 150 yds. = 900 yds.
900 × $.80 = $720
5% of $720 = $36
$720 − $36 = $684.

TRUE DISCOUNT.

PAGE 244.—*Oral Exercise.*

4. Since the amount of $1 for 2 years at 7% is $1.14, $\frac{114}{100}$ of the present worth equals the amount. If $228 is $\frac{114}{100}$ of the present worth, $\frac{1}{100}$ is $\frac{1}{114}$ of $228, which is $2, and $\frac{100}{100}$, or the present worth, is 100 times $2, or $200.

REMARK.—The 5th is solved in a similar manner.

6. The interest of $300 for 5 years at 6% is $90, and the amount, $300 plus $90, or $390. Since the amount of $1 for 5 years at 6% is $1.30, $\frac{130}{100}$, or $\frac{13}{10}$, of the present worth equals the amount. $\frac{1}{10}$ of the present worth is $\frac{1}{13}$ of $390, or $30, and $\frac{10}{10}$, or the present worth, is 10 times $30, or $300; hence, the discount is $390 minus $300, or $90.

NOTE.—It is evident in such examples as the 6th that the discount equals the interest if the note is discounted for the whole time.

7. Since the amount of $1 for 10 months at 6% is $1.05, $\frac{105}{100}$, or $\frac{21}{20}$, of the present worth equals the amount. If $1575 is $\frac{21}{20}$ of the present worth, $\frac{1}{20}$ is $\frac{1}{21}$ of $1575, or $75, and $\frac{20}{20}$ is 20 times $75, or $1500. If the seller offers to take $1490, by accepting the offer the buyer will make the difference between $1500 and $1490, or $10.

PAGE 245.—*Written Problems.*

(2.) Int. of $1 for 1 yr. 9 mo. at 6% = $.10$\frac{1}{2}$
Amt. of $1 " " " = 1.10\frac{1}{2}$
994.50 ÷ 1.10$\frac{1}{2}$ = 900. *Ans.*

.) Int. of $1 for 2 yr. 5 mo. at 6% = $.14$\frac{1}{2}$
Amt. of $1 " " " = 1.14\frac{1}{2}$
800 ÷ 1.14$\frac{1}{2}$ = 698.69
$800 − $698.69 = $101.31. *Ans.*

(4.) 2 yr. 6 mo. 18 d. = 2$\frac{11}{20}$ yr.
Int. of \$1 for 2$\frac{11}{20}$ yr. at 6% = \$.1785
Amt. of \$1 " " " = \$1.1785
1000 ÷ 1.1785 = 848.54. *Ans.*

(5.) 1 yr. 5 mo. 24 d. = 1$\frac{29}{60}$ yr.
Int. of \$1 for 1$\frac{29}{60}$ yr. at 6% = \$.089
Amt. of \$1 " " " = \$1.089
750 ÷ 1.089 = 688.71. *Ans.*

(6.) $\frac{1}{4}$ of \$20000 = \$5000, Cash.
\$20000 – \$5000 = \$15000
Amt. of \$1 for 2 yr. at 6% = \$1.12
15000 ÷ 1.12 = 13392.86
\$13392.86 + \$5000 = \$18392.86
\$18392.86 – \$15000 = \$3392.86. *Ans.*

(7.) Amt. of \$1 for 3 yr. @ 7% = \$1.21
2500 ÷ 1.21 = 2066.11. *Ans.*

(8.) 25% of \$900 = \$225
\$900 – \$225 = \$675
Amt. of \$1 for 9 mo. @ 6% = \$1.04$\frac{1}{2}$
900 ÷ 1.04$\frac{1}{2}$ = 861.24
\$861.24 – \$675 = \$186.24. *Ans.*

(9.) Amt. of \$1 for 9 mo. @ 6% = \$1.04$\frac{1}{2}$
25 ÷ 1.04$\frac{1}{2}$ = 23.92
Amt. of \$1 for 6 mo. @ 6% = \$1.03
24.50 ÷ 1.03 = 23.79
\$23.92 – \$23.79 = \$.13. *Ans.*

(10.) \$12500 − \$2500 = \$10000
$\frac{1}{2}$ of \$10000 = \$5000, Annual payment.
Amt. of \$1 for 1 yr. at 6% = \$1.06
5000 ÷ 1.06 = 4716.98
Amt. of \$1 for 2 yr. at 6% = \$1.12
5000 ÷ 1.12 = 4464.29
\$2500 + \$4716.98 + \$4464.29 = \$11681.27. *Ans.*

(11.) Amt. of \$150 for 9 mo. at 8% = \$159
Amt. of \$1 for 9 mo. at 6% = \$1.04$\frac{1}{2}$
159 ÷ 1.04$\frac{1}{2}$ = 152.15
Amt. of \$200 for 1 yr. 9 mo. at 8% = \$228
Amt. of \$1 for 1 yr. 9 mo. at 6% = \$1.10$\frac{1}{2}$
228 ÷ 1.10$\frac{1}{2}$ = 206.33
Amt. of \$200 for 2 yr. 9 mo. at 8% = \$244
Amt. of \$1 for 2 yr. 9 mo. at 6% = \$1.16$\frac{1}{2}$
244 ÷ 1.16$\frac{1}{2}$ = 209.44
\$50 + \$152.15 + \$206.33 + \$209.44 = \$617.92. *Ans.*

BANK DISCOUNT.

PAGE 247.

Three Days of Grace.

(3.) $\frac{726 \times 33}{60} = 399 = \$3.99.$

(4.) $\frac{180 \times 63 \times 7}{60 \times 6} = 221 = \$2.21.$

\$180 − \$2.21 = \$177.79, Proceeds.

(5.) $\frac{420.50 \times 93 \times 8}{60 \times 6} = 869.03 = \$8.69.$

(6.) $\frac{75.66 \times 63 \times 10}{60 \times 6} = 132 + = \$1.32$

\$75.66 − \$1.32 = \$74.34.

Four Days of Grace.

(3.) $\frac{726 \times 34}{60} = 411 = \$4.11.$

(4.) $\frac{180 \times 64 \times 7}{60 \times 6} = 224 = \$2.24.$

$\$180 - \$2.24 = \$177.76$, Proceeds.

(5.) $\frac{420.50 \times 94 \times 8}{60 \times 6} = 878.38 = \$8.78.$

(6.) $\frac{75.66 \times 64 \times 10}{60 \times 6} = 134 + = \$1.34.$

$\$75.66 - \$1.34 = \$74.32.$

PAGE 248.

Three Days of Grace.

(7.) $\frac{1322 \times 63}{60} = 1388 = \$13.88.$

$\$1322 - \$13.88 = \$1308.12$, Proceeds.

(8.) $\frac{173.24 \times 93 \times 10}{60 \times 6} = 448 - = \$4.48$

$\$173.24 - \$4.48 = \$168.76$, Proceeds.

(9.) $\frac{632.40 \times 33 \times 7}{60 \times 6} = 406 = \$4.06$

$\$632.40 - \$4.06 = \$628.34$, Proceeds.

Four Days of Grace.

(7.) $\frac{1322 \times 64}{60} = 1410 = \$14.10.$

$\$1322 - \$14.10 = \$1307.90$, Proceeds.

(8.) $\frac{173.24 \times 94 \times 10}{60 \times 6} = 452 = \$4.52.$

$\$173.24 - \$4.52 = \$168.72$, Proceeds.

(9.) $\frac{632.40 \times 34 \times 7}{60 \times 6} = 418 = \$4.18$

$\$632.40 - \$4.18 = \$628.22$, Proceeds.

(10.) Int. on note for 60 d. $= \$1.64$

$\$140.75 + \$1.64 = \$142.39 =$ Amt.

Discount from May 3 to June 2, 30 d.

$$\left.\begin{array}{l}\dfrac{142.39 \times 33}{60} = 78 = \$.78,\ \text{Dis.} \\ \$142.39 - \$.78 = \$141.61,\ \text{Proceeds.}\end{array}\right\}\ \text{3 d. grace.}$$

$$\left.\begin{array}{l}\dfrac{142.39 \times 34}{60} = 81 = \$.81,\ \text{Dis.} \\ \$142.39 - \$.81 = \$141.58,\ \text{Proceeds.}\end{array}\right\}\ \text{4 d. grace.}$$

CASE II.—PAGE 249.

(2.)

Bank dis. of \$1 for 63 d., at 7% $= \$.01\frac{9}{40}$.

Proceeds of \$1 " " " $= \$1 - \$.01\frac{9}{40} = \$.98\frac{31}{40}$.

Hence, $237.06 \div .98\frac{31}{40} = 240$, or \$240, the face of the note.

(3.)

Bank dis. of \$1 for 93 d. at 10% $= \$.02\frac{7}{12}$.

Proceeds of \$1 " " " $= \$1 - \$.02\frac{7}{12} = \$.97\frac{5}{12}$.

Hence, $650 \div .97\frac{5}{12} = 667.24$. *Ans.*

(4.)

$\dfrac{10 \times 2750}{2000}$ T. $= 13\frac{3}{4}$ T.

$13\frac{3}{4} \times \$20 = \$275$

Bank dis. of \$1 for 63 d. $= \$.0105$.

$\$1 - \$.0105 = \$.9895 =$ Proceeds.

$275 \div .9895 = 277.92 -$. *Ans.*

(5.)

Bank dis. of \$1 for 93 d. at 8% $= \$.02\frac{1}{15}$

$\$1 - \$.02\frac{1}{15} = \$.97\frac{14}{15} =$ Proceeds.

$73.25 \div .97\frac{14}{15} = 74.80$. *Ans.*

(6.)

$250 + $175 + $120 = $545

Bank dis. of $1 for 93 d. at 6% = $.0155

$1 − $.0155 = $.9845, Proceeds.

545 ÷ .9845 = 553.58. *Ans.*

BONDS.

PAGE 250.

(1.) 4000 × $$1.18\frac{1}{2}$ = $4740. *Ans.*

(2.) 5000 × $1.23 = $6150. *Ans.*

(3.) 5265 ÷ $1.17 = $4500. *Ans.*

(4.) 5000 × $.95 = $4750
7% of $5000 = $350
350 ÷ 4750 = $7\frac{7}{19}$%. *Ans.*

(5.) 57000 ÷ .95 = 60000
5% of $60000 = $3000. *Ans.*

(6.) .08 ÷ .90 = $.08\frac{8}{9}$
.07 ÷ .80 = $.08\frac{3}{4}$
$8\frac{8}{9}$% − $8\frac{3}{4}$% = $\frac{5}{36}$%. *Ans.*

(7.) 5's of '81 yield $5 int. per annum.
5.00 ÷ $.06\frac{1}{2}$ = $76\frac{12}{13}$. *Ans.*

(8.) 4800 ÷ .96 = 5000
6% of $5000 = $300
15% of $300 = $45 = Premium.
$300 + $45 = $345 = Gain.
345 ÷ 4800 = $7\frac{3}{16}$%. *Ans.*

(9.) $21200 \div 1.06 = 20000$
5-20's draw 6% int. in gold.
$6\% \text{ of } \$20000 = \$1200$
$1200 \times \$1.12\frac{1}{2} = \$1350$
$1350 \div 21200 = 6\frac{39}{106}\%$. *Ans.*

DOMESTIC EXCHANGE.

PAGE 253.

(2.) $\$1230 \times 1.00\frac{1}{2} = \$1236.15$. *Ans.*

(3.) $100 - \frac{3}{8} = 99\frac{5}{8}$
$\$125.60 \times .99\frac{5}{8} = \$125.13$.

(5.) $\$2100 \times 1.02 = \$2142 = \text{Cost of draft.}$
$\frac{2100 \times 33 \times 7}{60 \times 6} = 13.47\frac{1}{2} = \text{Discount.}$
$\$2142 - \$13.47\frac{1}{2} = \$2128.52\frac{1}{2}$. *Ans.*

(6.) $\$500 \times 1.00\frac{3}{4} = \$503.75 = \text{Cost.}$
$\frac{500 \times 63}{60} = 5.25 = \text{Discount.}$
$\$498.50$ *Ans.*

(7.) $\$350.40 \times .99\frac{1}{2} = \$348.65 = \text{Cost.}$
$\frac{350.40 \times 93}{60} = 5.43 = \text{Discount.}$
$\$343.22$ *Ans.*

(8.) $\$362 \times .98\frac{1}{2} = \$356.57 = \text{Cost.}$
$\frac{362 \times 33}{60} = 1.99 = \text{Discount.}$
$\$354.58$ *Ans.*

(11.) $\$122.46 \times .97\frac{1}{2} = \$125.60$.

(12.) Dis. of \$1 for 33 d. at 6% = \$.0055.
$.98\frac{3}{4} - .0055 = .9820$
$1560 \div .9820 = 1588.595$. *Ans.*

FOREIGN EXCHANGE.

PAGE 256.

(2.) $600 \times \$4.8665 = \$2919.90$

$5\frac{1}{2}\%$ prem. $= \underline{160.59}$

$\$3080.49$

(3.) $325 \times \$4.86 = \$1579.50.$

(4.) $1200 \times \$1.04 = \$1248$

$1248 \div .193 = 6466.32.$

(5.) 1500×5.18 fr. $= 7770$ fr.

(6.) $1600 \times \$.238 = \$380.80.$

(7.) $523.60 \div .238 = 2200.$

(8.) $400 \times \$4.865 = \$1946.$

$800 \times \$.734 = \underline{587.20}$

$\$2533.20$

12% of $\$2533.20 = \underline{303.98}$, Premium.

$\$2837.18$, Cost.

ARBITRATION OF EXCHANGE.

(2.) 1 £ $= 25.25 \times 1.08\frac{1}{5}$ marks $= 27.3205$ marks.

Since $27.3205 = 1$ £ $= \$4.86$

1 mark $= \$4.86 \div 27.3205$

$$6000 \text{ marks} = \frac{6000 \times \$4.86}{27.3205} = \$1067.33.$$

Solution 2d.

$$\frac{6000 \times \$4.86}{1.08\frac{1}{5} \times 25.25} = \$1067.33$$

PAGE 257.

(3.) $\$3500 \times 1.01\frac{1}{2} = \$3552.50$, Cost in Chicago.

Being at par between Chicago and New York, \$3552.50 = cost in New York.

$\$1.00 - \$.00\frac{1}{2} = \$.99\frac{1}{2}$, cost of \$1 in Reading.

$3552.50 \times \$.99\frac{1}{2} = \$3534.74$. *Ans.*

EQUATION OF PAYMENTS.

PAGE 258.—*Oral Exercise.*

3. The interest on \$30 for 10 months is the same as the interest on \$1 for 300 months, or on \$75 for as many months as 75 is contained times in 300, which is 4 months.

4. The interest on \$600 for 5 months is the same as the interest on \$1 for 3000 months, or on \$150 for as many months as 150 is contained times in 3000, or 20 months; hence, B should lend A \$150 for 20 months.

Written Problems.

(2.)

$$\begin{array}{llll}
50 \times 0 & & = 0 & \\
150 \times 10 & \text{mo.} & = 1500 & \text{mo.} \\
200 \times 22 & \text{"} & = 4400 & \text{"} \\
\underline{200} \times 34 & \text{"} & = \underline{6800} & \text{"} \\
600 & &)\underline{12700} & \text{mo.} \\
 & & 21\frac{1}{6} & \textit{Ans.}
\end{array}$$

(3.)

$$\begin{array}{llll}
600 \times 5 & \text{mo.} & = 3000 & \text{mo.} \\
1000 \times 10 & \text{"} & = 10000 & \text{"} \\
\underline{1200} \times 7\frac{5}{6} & \text{"} & = \underline{9400} & \text{"} \\
2800 & &)\underline{22400} & \text{mo.} \\
 & & 8 & \text{mo.}
\end{array}$$

(4.)

$$\begin{array}{rl}
300 \times 30 \text{ d.} = & 9000 \text{ d.} \\
600 \times 60 \text{ “ } = & 36000 \text{ “} \\
\underline{900} \times 90 \text{ “ } = & \underline{81000} \text{ “} \\
1800 \qquad\quad &)\underline{126000} \text{ d.} \\
 & \quad 70 \text{ d.}
\end{array}$$

70 d. from June 1 is Aug. 10.

(5.)

$$\begin{array}{rl}
300 \times 4 \text{ mo.} = & 1200 \text{ mo.} \\
800 \times 5 \text{ “ } = & 4000 \text{ “} \\
\underline{1000} \times 8 \text{ “ } = & \underline{8000} \text{ “} \\
2100 \qquad\quad &)\underline{13200} \text{ mo.} \\
 & \quad 6\tfrac{2}{7} \text{ mo.}
\end{array}$$

$6\tfrac{2}{7}$ mo., or 6 mo. 9 d., after Apr. 1 is Oct. 10.

(6.)

$$\begin{array}{rl}
25\% \text{ of } \$10000 = & \$2500 \\
20\% \text{ of } \$10000 = & \underline{\ 2000} \\
 & \$4500, \text{ Amt. paid.} \\
\$10000 - \$4500 = & \$5500, \text{ Remainder.}
\end{array}$$

$$\begin{array}{rl}
2500 \times 6 \text{ mo.} = & 15000 \text{ mo.} \\
2000 \times 18 \text{ “ } = & 36000 \text{ “} \\
\underline{5500} \times 30 \text{ “ } = & \underline{165000} \text{ “} \\
10000 \qquad\quad &)\underline{216000} \text{ mo.} \\
 & \quad 21\tfrac{3}{5} \text{ mo.} = 21 \text{ mo. } 18 \text{ d.}
\end{array}$$

PAGE 259.

8. The payment made Mar. 1 was 6 months before due; the payment made Apr. 1, 5 months before due; and the payment made July 1, 2 months before due.

$$\begin{array}{rl}
1000 \times 6 \text{ mo.} = & 6000 \text{ mo.} \\
200 \times 5 \text{ “ } = & 1000 \text{ “} \\
\underline{800} \times 2 \text{ “ } = & \underline{1600} \text{ “} \\
2000 \qquad\quad & 8600 \text{ mo.}
\end{array}$$

$\$3000 - \$2000 = \$1000$

$8600 \div 1000 = 8\tfrac{3}{5}$, or 8 mo. 18 d.

8 mo. + 8 mo. 18 d. = 16 mo. 18 d.

16 mo. 18 d. after Jan. 1, 1875, is May 19, 1876.

(9.)

$$\begin{array}{rcl} 500 \times 3 \text{ mo.} &=& 1500 \text{ mo.} \\ \underline{500} \times 1 \text{ “} &=& \underline{500} \text{ “} \\ 1000 && 2000 \text{ mo.} \end{array}$$

$\$1600 - \$1000 = \$600$

$2000 \div 600 = 3\tfrac{1}{3}$, or $3\tfrac{1}{3}$ mo.

Case II.—Page 260.

(2.)

$$\begin{array}{llrcrcl} \text{Due May} & 22, & \$200 & \times & 0 \text{ d.} & = & 0 \\ \text{“ June} & 28, & 300 & \times & 37 \text{ “} & = & 11100 \text{ d.} \\ \text{“ Aug.} & 16, & 500 & \times & 86 \text{ “} & = & 43000 \text{ “} \\ \text{“ Nov.} & 12, & \underline{200} & \times & 174 \text{ “} & = & \underline{34800} \text{ “} \\ & & \$1200 & & & & \overline{)88900} \text{ d.} \\ & & & & & & 75 - \end{array}$$

75 d. from May 22 is Aug. 5.

(3.)

$$\begin{array}{lllrcrcl} \text{Due Dec.} & 5, & 1875, & \$150 & & & & \\ \text{“ “} & 30, & \text{“} & 200 & \times & 25 \text{ d.} & = & 5000 \text{ d.} \\ \text{“ Jan.} & 24, & 1876, & 180 & \times & 50 \text{ “} & = & 9000 \text{ “} \\ \text{“ Mar.} & 16, & \text{“} & 320 & \times & 101 \text{ “} & = & 33320 \text{ “} \\ \text{“ Apr.} & 14, & \text{“} & 240 & \times & 130 \text{ “} & = & 31200 \text{ “} \\ \text{“ June} & 2, & \text{“} & \underline{347} & \times & 179 \text{ “} & = & \underline{62113} \text{ “} \\ & & & \$1437 & & & & \overline{)140633} \text{ d.} \\ & & & & & & & 98 - \end{array}$$

Equated time, 98 days from Dec. 5, 1875 = Mar. 12, 1876.

(4.)

Due July 31, 1200 × $1.50 = $1800; 1800 × 0 =
" Aug. 15, 500 × 2.50 = 1250; 1250 × 15 d. = 18750 d.
" Sept. 11, 600 × 2.25 = 1350; 1350 × 42 " = 56700 "
" Oct. 14, 800 × .90 = 720; 720 × 75 " = 54000 "
" Sept. 19, 800 × 1.30 = 1040; 1040 × 50 " = 52000 "
$6160)181450 d.
30 – d.

Equated time, 30 days after July 31, or August 30.

(5.) Due Sept. 3, $100 × 0 =
" " 10, 200 × 7 d. = 1400 d.
" Oct. 4, 300 × 31 " = 9300 "
" Nov. 2, 500 × 60 " = 30000 "
$1100)40700 d.
37 d.

Equated time, 37 days after June 5, or July 12.

EQUATION OF ACCOUNTS.

PAGE 262.

(2.)

Due.	Time.	Items.	Product.	Due.	Time.	Items.	Product.
Apr. 6,	......	$10		May 4,	28 d.	$90	2520
May 13,	37 d.	300	11100	" 31,	55 d.	200	11000
June 5,	60 d.	182	10920	June 2,	57 d.	140	7980
		$492	22020			$430	21500
		430	21500				
	Bal. =	$62	)520				
			9 –				

Hence, Balance due 9 days after Apr. 6, or Apr. 15.

(3.)

Due.	Time.	Items.	Product.	Due.	Time.	Items.	Product.
Jan. 3,	……	$600		Feb. 3,	31 d.	$400	12400
Feb. 12,	40 d.	450	18000	Mar. 28,	84 d.	400	33600
Apr. 1,	88 d.	250	22000	Apr. 6,	93 d.	200	18600
		$1300	40000			$1000	64600
		1000					40000
	Bal. =	$300					300)24600
							82

82 days before Jan. 3, 1875, is Oct. 13, 1874.

(4.)

Due.	Time.	Items.	Product.	Due.	Time.	Items.	Product.
Feb. 20,	……	$140		June 15,	115 d.	$300	34500
Mar. 15,	23 d.	150	3450	Aug. 4,	165 d.	200	33000
Apr. 3,	42 d.	650	27300	" 18,	179 d.	200	35800
" 20,	59 d.	217	12803				
May 12,	81 d.	144	11664				
Aug. 10,	171 d.	355	60705				
		$1656	115922			$700	103300
		700	103300				
	Bal. =	$956	)12622				
			14 –				

Due 14 days after Feb. 20, or Mar. 6.

(5.)

Due.	Time.	Items.	Products.	Due.	Time.	Items.	Product.
1878.				1878.			
Nov. 4,	31 d.	$600	18600	Oct. 4,	……	$200*	
Dec. 5,	62 d.	200	12400	Dec. 15,	72 d.	600	43200
" 4,	61 d.	300	18300	1879.			
1879.				Jan. 1,	89 d.	500	44500
Feb. 15,	134 d.	120	16080				
" 5,	124 d.	145	17980				
		$1365	83360			$1300	87700
		1300					83360
	Bal.	=$65					65)4340
							67 – d.

67 days previous to Oct. 4, 1878, or July 29, 1878.

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* The first item due is the cash paid Oct. 4; hence, all the items must be averaged from this date.

CASH BALANCE.

PAGE 264.

(2.) *Dr.*

Int. on $60 from Jan. 5 to Aug. 1, 208 d., $2.08
" " 40 " Feb. 3 to Aug. 1, 179 d., 1.19
" " 120 " July 10 to Aug. 1, 22 d., .44 $3.71

Cr.

Int. on $20 from Mar. 15 to Aug. 1, 139 d., $.46
" " 60 " Apr. 10 to Aug. 1, 113 d., 1.13
" " 50 " May 3 to Aug. 1, 90 d., .75
" " 35 " Aug. 1 to Sept. 4, 34 d., .20 2.54
Bal. of Int., $1.17

Dr. JOHN A. ROBB. *Cr.*

1873.				1873.			
Jan. 5	Mdse.	$60	00	Mar. 15	Cash	$20	00
Feb. 3	"	40	00	Apr. 10	"	60	00
July 10	"	120	00	May 3	"	50	00
Sept. 4	"	35	00				
Aug. 1	Interest	1	17	Aug. 1	Cash Bal.	126	17
		$256	17			$256	17

(3.) *Dr.*

Int. on $125 from Oct. 1, 1878, to Jan. 1, 1879, 92 d., $1.92
" " 40 " Nov. 5, " to " " 57 d., .38
" " 125 " Dec. 1, " to " " 31 d., .65
" " 40 " Dec. 16, " to " " 16 d., .11 $3.06

Cr.

Int. on $100 from Oct. 6, 1878, to Jan. 1, 1879, 87 d., $1.45
" " 20 " Oct. 15, " to " " 78 d., .26
" " 100 " Dec. 10, " to " " 22 d., .37
" " 50 " Dec. 16, " to " " 16 d., .13 2.21
Bal. of Int., $.85

Dr. L. A. MACKEY. *Cr.*

1878.				1878.			
Oct. 1	Rent	$125	00	Oct. 6	Cash	$100	00
Nov. 5	Mdse.	40	00	Oct. 15	"	20	00
Dec. 1	Rent	125	00	Dec. 10	"	100	00
Dec. 16	Hay	40	00	Dec. 16	"	50	00
1879.							
Jan. 1	Rent	62	50	1879.			
Jan. 1	Interest		85	Jan. 1	Cash Bal.	123	35
		$393	35			$393	35

SIMPLE PARTNERSHIP.

PAGE 265.

(2.) $2000
4000
10000
$16000 = Amount invested.
6400 ÷ 16000 = 40% = Gain.
40% of $2000 = $800 = 1st.
40% of $4000 = $1600 = 2d.
40% of $10000 = $4000 = 3d.

(3.) $45000 – $10000 = $35000 = Gain.
35000 ÷ 10000 = 350% = "
350% of $1500 = $5250 = A's "
350% of $2000 = $7000 = B's "
350% of $2500 = $8750 = C's "
350% of $4000 = $14000 = D's gain.

PAGE 266.

(4.) 300 ÷ 2500 = 12% = Gain.
12% of $500 = $60 = A's gain.
12% of $1200 = $144 = B's "
12% of $800 = $96 = C's "

(5.) 16 cows + 14 cows + 12 cows = 42 cows.
$\frac{1}{42}$ of \$1200 = \$28$\frac{4}{7}$ = Pasturage of 1 cow.
16 × \$28$\frac{4}{7}$ = \$457$\frac{1}{7}$ = Rankin's share.
14 × \$28$\frac{4}{7}$ = \$400 = Barton's "
12 × \$28$\frac{4}{7}$ = \$342$\frac{6}{7}$ = Boggis's "

(6.)
$$\begin{array}{r} \$18000 \\ 6000 \\ 10000 \\ \hline \$34000 \end{array} = \text{Stock.}$$
$$\begin{array}{r} .30 \\ \hline \$11200 \end{array} = \text{Loss.}$$
\$34000 – \$11200 = \$23800, Rem.
50% of \$23800 = 11900, Gain.
$\overline{\$35700}$
\$35700 – \$34000 = \$1700, Net gain.
1700 ÷ 34000 = 5%, "
5% of \$18000 = \$900, A's gain.
5% of \$6000 = \$300, B's "
5% of \$10000 = \$500, C's "

(7.) \$1000 + \$800 = \$1800
\$2250 – \$1800 = \$450, C's gain.
450 ÷ 3000 = 15%, or $\frac{3}{20}$ = Gain.
\$800 = $\frac{3}{20}$, A's capital.
$\frac{1}{20}$ = $\frac{1}{3}$ of \$800 = \$266$\frac{2}{3}$
$\frac{20}{20}$ = 20 × \$266$\frac{2}{3}$ = \$5333$\frac{1}{3}$, A's.
\$1000 = $\frac{3}{20}$, B's capital.
$\frac{1}{20}$ = $\frac{1}{3}$ of \$1000 = \$333$\frac{1}{3}$
$\frac{20}{20}$ = 20 × \$333$\frac{1}{3}$ = \$6666$\frac{2}{3}$, B's.

(8.) $6500
8000
5500
$20000, Amount willed.
12000 ÷ 20000 = 60%, Paid.
60% of $6500 = $3900, Son's share.
60% of $8000 = $4800, Widow's share.
60% of $5500 = $3300, Daughter's share.

(9.) $16000, Cost.
2500, Clerk hire.
600, Rent.
$19100
$23000 − $19100 = $3900 = Gain.
3900 ÷ 16000 = $24\frac{3}{8}$% = Gain.
$24\frac{3}{8}$% of $5000 = 1218.75 = John's.
$24\frac{3}{8}$% of $6500 = $1584.37\frac{1}{2}$ = James'.
$24\frac{3}{8}$% of $4500 = $1096.87\frac{1}{2}$ = George's.

COMPOUND PARTNERSHIP.

PAGE 267.

(2.) 3 × 16 wk. = 48 wk.
5 × 20 " = 100 "
7 × 10 " = 70 "
218 wk.
1 wk. cost $\frac{1}{218}$ of $87.20 = $.40
48 wk. = 48 × $.40 = $19.20 = A's.
100 wk. = 100 × $.40 = $40.00 = B's.
70 wk. = 70 × $.40 = $28.00 = C's.

(3.) \$4200
3600
4500
\$12300, Capital invested.
2706 ÷ 12300 = 22%
22% of \$4200 = \$924 = D's share.
22% of \$3600 = \$792 = E's "
22% of \$4500 = \$990 = F's "

(4.) 7 × 30 d. = 210 d.
5 × 40 " = 200 "
6 × 32 " = 192 "
602 days' work.
\$1600 − \$95 = \$1505
$\frac{1}{602}$ of \$1505 = \$2½, Daily wages.
210 × \$2½ = \$525, Salmon's.
200 × \$2½ = \$500, McNerney's.
192 × \$2½ = \$480, Scheid's.

PAGE 268.

(5.) A = { \$6000 for 12 mo. = \$1 for 72000 mo.
{ \$2000 " 6 " = \$1 " 12000 "
84000 mo.
B = { \$5000 for 12 mo. = \$1 for 60000 mo.
{ \$3000 " 5 " = \$1 " 15000 "
75000 mo.
C = { \$4500 for 12 mo. = \$1 for 54000 mo.
{ \$3500 " 4 mo. = \$1 " 14000 "
68000 mo.
84000 + 75000 + 68000 = 227000
$\frac{1}{227000}$ of \$4540 = \$.02
84000 × \$.02 = \$1680 = A's.
75000 × \$.02 = \$1500 = B's.
68000 × \$.02 = \$1360 = C's.

(6.)

Bowman, { $5000 for 6 mo. = $1 for 30000 mo.
$4000 " 6 " = $1 " 24000 " 54000 mo.

Johnson, { $6000 for 7 mo. = $1 for 42000 mo.
$3500 " 5 " = $1 " 17500 " 59500 mo.

Bittner, { $7500 for 8 mo. = $1 for 60000 mo.
$2500 " 4 " = $1 " 10000 " 70000 mo.
183500 mo.

$7340 – $1835 = $5505, Net gain.
$\frac{1}{183500}$ of \$5505 = \$.03
54000 × $.03 = $1620, Bowman's gain.
59500 × $.03 = $1785, Johnson's "
70000 × $.03 = $2100, Bittner's "

(7.)

Lesher, { $3000 for 3 mo. = $1 for 9000 mo.
$6000 " 4 " = $1 " 24000 "
$4000 " 5 " = $1 " 20000 " 53000 mo.

Clark, { $2500 for 4 mo. = $1 for 10000 mo.
$6500 " 4 " = $1 " 26000 "
$3500 " 4 " = $1 " 14000 " 50000 mo.

Bickford, { $4000 for 5 mo. = $1 for 20000 mo.
$6000 " 4 " = $1 " 24000 "
$3500 " 3 " = $1 " 10500 " 54500 mo.
157500 mo.

$7000 – $700 = $6300, Net gain.
$\frac{1}{4}$ of \$6300 = \$1575, Schuyler's gain.
$6300 – $1575 = $4725
$\frac{1}{157500}$ of \$4725 = \$.03.
53000 × $.03 = $1590 = Lesher's gain.
50000 × $.03 = $1500 = Clark's "
54500 × $.03 = $1635 = Bickford's "

Lesher's cap'l end of yr. = \$3000 + \$3000 − \$2000 = \$4000.
Clark's " " " = \$2500 + \$4000 − \$3000 = \$3500.
Bickford's " " " = \$4000 + \$2000 − \$2500 = \$3500.

(8.)

Noyes, { \$10000 for 8 mo. = \$1 for 80000 mo.
7000 " 4 " = \$1 " 28000 " 108000 mo.

Barrows. { \$6000 for 9 mo. = \$1 for 54000 mo.
8000 " 3 " = \$1 " 24000 " 78000 mo.

Hipple, { \$8000 for 10 mo. = \$1 for 80000 mo.
7400 " 2 " = \$1 " 14800 " 94800 mo.
280800 mo.

\$3842 − \$800 = \$3042, Net gain.
$\frac{1}{280800}$ of \$3042 = $\frac{169}{15600}$\$
108000 × $\frac{169}{15600}$\$ = \$1170, Noyes' gain.
78000 × $\frac{169}{15600}$\$ = \$845, Barrows' "
94800 × $\frac{169}{15600}$\$ = \$1027, Hipple's "

ALLIGATION.

PAGE 269.—*Oral Exercise.*

3. Twenty sheep at 5 dollars a head are worth 100 dollars, ten at 4½ dollars a head are worth 45 dollars, and twenty at 3 dollars a head are worth 60 dollars; the total number is twenty, ten, and twenty, or fifty, and the total cost \$100 + \$45 + \$60, or \$205. Hence, the average price is $\frac{1}{50}$ of \$205, or \$4.10.

Written Problems.

(4.)

$$\begin{array}{rl}
60 \times \$1.25 = & \$75.00 \\
47 \times \ \ 1.30 = & 61.10 \\
55 \times \ \ 1.32 = & 72.60 \\
\underline{38} \times \ \ 1.20 = & \underline{45.60} \\
200 \text{ bu.} \quad = & \$254.30
\end{array}$$

$$1 \text{ bu.} = \tfrac{1}{200} \text{ of } \$254.30 = \$1.27\tfrac{3}{20}.$$

PAGE 270.

(5.)

$$\begin{array}{rl}
150 \times \$.10 \ \ = & \$15.00 \\
120 \times \ .07\tfrac{1}{2} = & 9.00 \\
144 \times \ .14\tfrac{1}{2} = & 20.88 \\
\underline{160} \times \ .15 \ \ = & \underline{24.00} \\
574 \text{ yd.} \quad = & \$68.88 \\
25\% \text{ of } \$68.88 = & \underline{17.22} \\
 & \$86.10
\end{array}$$

$$1 \text{ yd. cost } \tfrac{1}{574} \text{ of } \$86.10 = 15¢.$$

(6.)

$$\begin{array}{rl}
600 \times \$.23 = & \$138.00 \\
800 \times \ .26 = & 208.00 \\
\underline{960} \times \ .30 = & \underline{288.00} \\
2360 \text{ lbs.} \quad = & \$634.00 \\
2360 \times \$.31 = & \$731.60
\end{array}$$

$$\$731.60 - \$634 = \$97.60, \text{ Gain.}$$

CASE II.—PAGE 270.

(2.)

$$12 \left\{ \begin{array}{r|c|c|c|c} 9 & \frac{1}{3} & & \frac{1}{3} & \frac{2}{6} \\ 14 & & \frac{1}{2} & \frac{1}{2} & \frac{3}{6} \end{array} \right. \text{ or } \begin{array}{c} 2 \\ 3 \end{array}$$

(3.)

$$16 \left\{ \begin{array}{r|c|c|c|c|c} 12 & \frac{1}{4} & & \frac{1}{4} & & 1 \\ 15 & 1 & & & 1 & 2 \\ 18 & & \frac{1}{2} & & \frac{1}{2} & 1 \\ 20 & & \frac{1}{4} & \frac{1}{4} & & 1 \end{array} \right.$$

NOTE.—Other answers also may be found to this question. Any answer which proves should be accepted as correct.

(4.)

$$2.00\left\{\begin{array}{r|c|c|c|c|l} 1.50 & \frac{1}{50} & & \frac{1}{50} & & 4, \\ 1.75 & \frac{1}{25} & & & \frac{1}{25} & 4, \\ 2.20 & & \frac{1}{20} & & \frac{1}{20} & 5, \\ 2.40 & & \frac{1}{40} & \frac{1}{40} & & 5, \end{array}\right. \text{etc.}$$

PAGE 271.

(5.)

$$2.50\left\{\begin{array}{r|c|c|c|c|l|r} 3.00 & \frac{1}{50} & & \frac{1}{50} & & 5 & =5 \\ 3.50 & \frac{1}{100} & & & \frac{1}{100} & & 5=5 \\ 0.00 & & \frac{1}{250} & \frac{1}{250} & \frac{1}{250} & 1+ & 2=3 \end{array}\right.$$

(6.)

$$7.50\left\{\begin{array}{r|c|c|c|c|c|c|c|r|l} 5.00 & \frac{1}{250} & & \frac{1}{250} & & & 1 & & & 1 \\ 6.00 & \frac{1}{150} & & & \frac{1}{150} & & & 5 & & 5 \\ 7.00 & \frac{1}{50} & & & & \frac{1}{50} & & & 5 & =5 \\ 10.00 & & \frac{1}{250} & \frac{1}{250} & \frac{1}{250} & \frac{1}{250} & 1 & +3 & +1 & 5 \end{array}\right.$$

(7.)

$$3.25\left\{\begin{array}{r|c|c|c|c|c|c|c|c|c} 2.25 & \frac{1}{100} & & \frac{1}{100} & & & 3 & & & 3 \\ 2.50 & \frac{1}{75} & & & \frac{1}{75} & & & 1 & & 1 \\ 2.75 & \frac{1}{50} & & & & \frac{1}{50} & & & 3 & 3 \\ 4.00 & & \frac{1}{75} & \frac{1}{75} & \frac{1}{75} & \frac{1}{75} & 4 & 1 & 2 & 7 \end{array}\right.$$

CASE III.—PAGE 271.

(2.)

$$90\left\{\begin{array}{r|c|c|c|c} 40 & \frac{1}{50} & & \frac{1}{50} & 3 \\ 120 & & \frac{1}{80} & \frac{1}{80} & 5 \end{array}\right\} \times 10 = \left\{\begin{array}{l} 30 \\ 50 \end{array}\right.$$

(3.)

$$67\left\{\begin{array}{r|c|c|c|c|c|c|c|c|c} 60 & \frac{1}{7} & & \frac{1}{7} & & & 3 & & & 3 \\ 62 & \frac{1}{5} & & & \frac{1}{5} & & & 3 & & 3 \\ 65 & \frac{1}{2} & & & & \frac{1}{2} & & & 3 & 3 \\ 70 & & \frac{1}{8} & \frac{1}{8} & \frac{1}{8} & \frac{1}{8} & 7 & 5 & 2 & 14 \end{array}\right\} \times 5 = \left\{\begin{array}{l} 15 \\ 15 \\ 15 \\ 70 \end{array}\right.$$

(4.)

$$3.20\left\{\begin{array}{l|c|c|c|c|c|c|c|c|c}
4.00 & \frac{1}{80} & & \frac{1}{80} & & & 5 & & & 5 \\
3.50 & \frac{1}{80} & & & \frac{1}{80} & \frac{1}{80} & & 4 & 7 & 11 \\
2.20 & & \frac{1}{100} & \frac{1}{100} & & & 4 & & & 4 \\
2.00 & & \frac{1}{120} & & \frac{1}{120} & & & 1 & & 1 \\
2.50 & & \frac{1}{70} & & & \frac{1}{70} & & & 3 & 3
\end{array}\right\}\times 10=\left\{\begin{array}{r}50\\110\\40\\10\\30\end{array}\right.$$

Page 272.

(5.)

$$80\left\{\begin{array}{r|c|c|c|c|c|c|c}
95 & \frac{1}{15} & & \frac{1}{15} & & 16 & & 16 \\
90 & \frac{1}{10} & & & \frac{1}{10} & & 8 & 8 \\
0 & & \frac{1}{80} & \frac{1}{80} & \frac{1}{80} & 3 & 1 & 4
\end{array}\right\}\times\frac{3}{8}=\left\{\begin{array}{l}6\\3\\1\frac{1}{2}\end{array}\right.$$

Case IV.—Page 272.

(2.)

$5\times 10=50$

$\frac{1}{50}$ of \$450 = \$9, Average wages.

$$9\left\{\begin{array}{r|c|c|c|c}
15 & \frac{1}{6} & & \frac{1}{6} & 2 \\
5 & & \frac{1}{4} & \frac{1}{4} & 3
\end{array}\right\}\times 2=\begin{array}{c}4\\6\end{array}$$

(3.)

$\frac{1}{100}$ of \$33 = 33¢

$$\begin{array}{r|c|c|c|c|c|c|}
 & & & & & a & b \\
30 & \frac{1}{3} & & \frac{1}{3} & & 2 & \\
28 & \frac{1}{5} & & & \frac{1}{5} & & 2 \\
35 & & \frac{1}{2} & \frac{1}{2} & \frac{1}{2} & 3 & 5 \\
\hline
 & & & & & 5 & 7
\end{array}$$

with 33 before the brace.

Multiplying column *a* by 6 and column *b* by 10, we have 12 at 30 cts., 20 at 28 cts., and 68 at 35 cts.

Multiplying column *a* by 13, and column *b* by 7, also gives a correct result.

(4.)

$\frac{1}{50}$ of \$8.00 = 16¢

$$16\left\{\begin{array}{r|c|c|c|c|c|c|}
 & & & & & a & b \\
13 & \frac{1}{3} & & \frac{1}{3} & & 5 & \\
14 & \frac{1}{2} & & & \frac{1}{2} & & 1 \\
18 & & \frac{1}{2} & & \frac{1}{2} & & 1 \\
21 & & \frac{1}{5} & \frac{1}{5} & & 3 & \\
\hline
 & & & & & 8 & 2
\end{array}\right.$$

Multiply column *a* by 5, and column *b* by 5, for second result.

Multiply column *a* by 2, and column *b* by 17, for third result.

Second Solution.

$$16\left\{\begin{array}{r|c|c|c|c|c|c|} & & & & & a & b \\ 13 & \frac{1}{3} & & \frac{1}{3} & & 2 & \\ 14 & \frac{1}{2} & & & \frac{1}{2} & & 5 \\ 18 & & \frac{1}{2} & \frac{1}{2} & & 3 & \\ 21 & & \frac{1}{5} & & \frac{1}{5} & & 2 \\ \cline{6-7} & & & & & 5 & 7 \end{array}\right.$$

Multiply column *a* by 3, and column *b* by 5, for first result.

(5.)

$\frac{1}{80}$ of \$48 = 60¢

$$60\left\{\begin{array}{r|c|c|c|c|c|c|r} 85 & \frac{1}{25} & & \frac{1}{25} & \frac{1}{25} & 6 & 4 & 10 \\ 30 & & \frac{1}{30} & \frac{1}{30} & & 5 & & 5 \\ 40 & & \frac{1}{20} & & \frac{1}{20} & & 5 & 5 \end{array}\right\}\times 4 = \left\{\begin{array}{r} 40 \\ 20 \\ 20 \end{array}\right.$$

POWERS.

PAGE 274.

(2.) $1^3 = 1 \times 1 \times 1 = 1.$

(3.) $23^2 = 23 \times 23 = 529.$

(5.) $216^3 = 216 \times 216 \times 216 = 10077696.$

(7.) $19^5 = 19 \times 19 \times 19 \times 19 \times 19 = 2476099.$

(8.) $6.1^2 = 6.1 \times 6.1 = 37.21.$

(11.) $(\frac{4}{5})^3 = \frac{4}{5} \times \frac{4}{5} \times \frac{4}{5} = \frac{64}{125}.$

(12.) $(\frac{1}{2})^6 = \frac{1}{2} \times \frac{1}{2} \times \frac{1}{2} \times \frac{1}{2} \times \frac{1}{2} \times \frac{1}{2} = \frac{1}{64}.$

(13.) $(2\frac{1}{3})^3 = \frac{7}{3} \times \frac{7}{3} \times \frac{7}{3} = \frac{2401}{81}.$

(14.) $(3\frac{1}{2} \times \frac{2}{5})^3 = \frac{7}{2} \times \frac{2}{5} \times \frac{7}{2} \times \frac{2}{5} \times \frac{7}{2} \times \frac{2}{5} = \frac{343}{125}.$

(15.) $(3\frac{1}{4} + 2\frac{1}{3})^2 = \frac{67}{12} \times \frac{67}{12} = \frac{4489}{144} = 31\frac{25}{144}.$

(16.) $\left(\frac{\frac{7}{8}}{3\frac{1}{4}}\right)^3 = \frac{7}{8} \times \frac{4}{13} \times \frac{7}{8} \times \frac{4}{13} \times \frac{7}{8} \times \frac{4}{13} = \frac{343}{17576}.$

ROOTS.

PAGE 275.

1. Square Root of 625 = 25. Of 1728 = 41 +. Of 6561 = 81.

2. Cube Root of 729 = 9. Of 3375 = 15. Of 970299 = 99. Of 13824 = 24.

PAGE 277.

(10.) $9\dot{2}4\dot{7}6\dot{8}1 \,|\, \underline{3041.}$ *Ans.*

9

$\underline{604}|2476$

2416

$\underline{6081}|6081$

6081

(11.) $\sqrt{\frac{81}{100}}=\frac{\sqrt{81}}{\sqrt{100}}=\frac{9}{10}.$

(12.) $\sqrt{\frac{144}{225}}=\frac{\sqrt{144}}{\sqrt{225}}=\frac{12}{15}.$

(13.) $\sqrt{\frac{441}{1089}}=\frac{\sqrt{441}}{\sqrt{1089}}=\frac{21}{33}.$

(14.) $.02\dot{8}9 \,|\, \underline{.17}$

$.01$

$\underline{27}|189$

189

(15.) $.00\dot{3}9\dot{6}9 \,|\, \underline{.063}$

$.00$

39

36

$\underline{123}|369$

369

(16.) $64.11\dot{2}0\dot{4}9 \,|\, \underline{8.007}$

64

$\underline{16007} \,|\, 112049$

112049

(17.) $49.70\dot{2}5 \,|\, \underline{7.05}$

49

$\underline{1405} \,|\, 7025$

7025

(18.) $10 \,|\, \underline{3.1622+}$

9

$\underline{61} \,|\, 100$

61

$\underline{626} \,|\, 3900$

3756

$\underline{6322} \,|\, 14400$

12644

$\underline{63242} \,|\, 175600$

126484

(19.) $\frac{3}{5} = .6$

$.60\dot{0}0 \,|\, \underline{.7746-}$

$.49$

$\underline{147} \,|\, 1100$

1029

$\underline{1544} \,|\, 7100$

6176

$\underline{15486} \,|\, 92400$

92916

(20.) $\sqrt{\frac{1}{3}} = \sqrt{\frac{3}{9}} = \sqrt{\frac{1}{9} \times 3} = \frac{1}{3}\sqrt{3}.$

PROBLEMS, PAGE 277.

(1.) 1 A. = 43560 sq. ft. = 6272640 sq. in.

$\sqrt{6272640 \text{ sq. in.}}$ = 2504.52 in. = 208 ft. 8.52 in.

(2.) 4 A. = 25090560 sq. in.
$\sqrt{25090560 \text{ sq. in.}} = 5009.04$ in. = 417 ft. 5.04 in.

(3.) 10 A. = 10 × 43560 sq. ft. = 435600 sq. ft.
$\sqrt{435600 \text{ sq. ft.}} = 660$ ft., Length of side.
660 ÷ 15 = 44, No. panels each side.
44 × 5 = 220, No. rails " "
4 × 220 = 880, Whole No. rails.
$\frac{880 \times \$6}{100} = \$52.80$, Cost of rails.
44 × 4 = 176, Whole No. posts.
$\frac{176 \times \$40}{100} = \$70.40$, Cost of posts.
10 × $1.50 = $15, Cost of labor.
$52.80 + $70.40 + $15 = $138.20, Cost of all.

PAGE 278.

(4.) 122 A. 80 P. = 19600 P.
$\sqrt{19600} = 140$ P., Length of field.
4 × 140 P. = 560 P.,Total boundary fences.
½ of 560 P. = 280 P., ½ Boundary fences.
2 × 140 P. = 280 P., Division fences.
280 P. + 280 P. = 560 P., Total fences.
560 × 16½ ft. = 9240 ft.
9240 ÷ 15 = 616, No. of panels.
616 × 5 = 3080, No. of rails.
$\frac{3080 \times \$6.25}{100} = \$192.50$, Cost of rails.
616 × $.42 = $258.72, Cost of posts.
48 × $1.75 = $84, Labor.
$192.50 + $258.72 + $84 = $535.22, Total cost.
122 A. 80 P. = 122½ A.
$535.22 ÷ 122½ = $4.37 –, Cost per acre.

CUBE ROOT.

PAGE 280.

(5.)

$$\begin{array}{rrr|r}
 & & 11\dot{3}90\dot{6}25 & 200\\
2^3 = & & 8 & 20\\
20^2\times 3 = & 1200\;) & 3390 & 5\\
20\times 2\times 3 = & 120 & & 225\\
2\times 2 = & 4 & & \\
3\;\times & 1324 = & 2648 & \\
220^2\times 3 = & 145200\;) & 742625 & \\
220\times 5\times 3 = & 3300 & & \\
5\times 5 = & 25 & & \\
5\;\times & 148525 = & 742625 &
\end{array}$$

(6.)

$$\begin{array}{rrr|r}
 & & 36\dot{9}26\dot{0}37 & 300\\
3^3 = & & 27 & 30\\
\overline{30}^2\times 3 = & 2700\;) & 9926 & 3\\
30\times 3\times 3 = & 270 & & 333\\
3\times 3 = & 9 & & \\
3\;\times & 2979 = & 8937 & \\
330^2\times 3 = & 326700\;) & 989037 & \\
330\times 3\times 3 = & 2970 & & \\
3\times 3 = & 9 & & \\
3\;\times & 329679 = & 989037 &
\end{array}$$

(7.)

$$\begin{array}{rrr|r}
 & & 150\dot{5}68768 & 500\\
5^3 = & & 125 & 30\\
\overline{50}^2\times 3 = & 7500 &)25568 & 2\\
50\times 3\times 3 = & 450 & & 532\\
3\times 3 = & 9 & & \\
3\times & 7959 = & 23877 & \\
530^2\times 3 = & 842700) & 1691768 & \\
530\times 2\times 3 = & 3180 & & \\
2\times 2 = & 4 & & \\
2\times & 845884 = & 1691768 &
\end{array}$$

Remark.—The 8th, 9th, 10th, and 11th are solved in a similar manner.

(12.) Find the cube root of the numerator and the denominator separately.

(14.)

$$
\begin{array}{llll}
 & & 41.06\dot{3}625 & |\,3.00 \\
3^3 = & & 27. & \;\;.40 \\
\overline{30}^2\times 3 & = 2700 &)14.063 & \;\;.05 \\
30\times 4\times 3 = & 360 & & 3.45 \\
4\times 4 & = 16 & & \\
4\times 3076 = & 12.304 & & \\
\overline{340}^2\times 3 & = 346800 &)17.59625 & \\
340\times 5\times 3 = & 5100 & & \\
5\times 5 & = 25 & & \\
5\times 351925 = & 17.59625 & &
\end{array}
$$

(15.)

$$
\begin{array}{llll}
 & & \dot{9}.000\dot{0}00 & |\,2.00000 \\
2^3 = & & 8. & \;\;00000 \\
\overline{20}^2\times 3 & = 1200 &)1.000 & \;\;8008 \\
 & & & 2.08008+ \quad \textit{Ans.} \\
\overline{200}^2\times 3 & = 120000 &)1000000 & \\
200\times 8\times 3 = & 4800 & & \\
8\times 8 & = 64 & & \\
8\times 124864 = & & 998912 & \\
\overline{2080}^2\times 3 = & 12979200 &)1088000 & \\
\overline{20800}^2\times 3 = & 1297920000 &)1088000000 & \\
\overline{208000}^2\times 3 & 129792000000 &)1088000000000 & \\
208000\times 8\times 3 = & 4992000 & & \\
8\times 8 = & 64 & & \\
8\times 129796992064 = & 1038375936512 & &
\end{array}
$$

(16.)

$$\begin{array}{lrl|r}
 & & 12\dot{8}95\dot{2}13\dot{6}25 & 2000 \\
2^3 = & & \underline{8} & 300 \\
\overline{20}^2 \times 3 = & 1200 &)4895 & 40 \\
20 \times 3 \times 3 = & 180 & & \underline{5} \\
3 \times 3 & \underline{9} & & 2345 \quad \textit{Ans.} \\
 & 3 \times \overline{1389} = & \underline{4167} & \\
\overline{230}^2 \times 3 = & 158700 &)728213 & \\
230 \times 4 \times 3 = & 2760 & & \\
4 \times 4 & \underline{16} & & \\
 & 4 \times \overline{161476} = & \underline{645904} & \\
\overline{2340}^2 \times 3 & = 16426800 &)82309625 & \\
2340 \times 5 \times 3 = & 35100 & & \\
5 \times 5 \quad = & \underline{25} & & \\
 & 5 \times \overline{16461925} = & 82309625 &
\end{array}$$

Problems.—PAGE 280.

(1.) 1 bus. = 2150.42 cu. in.
$\sqrt[3]{2150.42} = 12.89+$. *Ans.*

(2.) 200×2150.42 cu. in. = 430084 cu. in.
$\sqrt[3]{430084} = 75.49-$. *Ans.*

(3.) $(6\text{ in.})^3 = 216$ cu. in.
216 cu. in. − 6 cu. in. = 210 cu. in.

(4.) 80×128 cu. ft. = 10240 cu. ft.
$\sqrt[3]{10240} = 21.71+$. *Ans.*

(5.) 1500×231 cu. in. = 346500 cu. in.
$\sqrt[3]{346500} = 70.24-$. *Ans.*

(6.) 15 ft. × 36 ft. × 50 ft. = 27000 cu. ft.
$\sqrt[3]{27000}$ cu. ft. = 30 ft.

$36 \times 50 = 1800 =$ floor.
$36 \times 50 = 1800 =$ ceiling.
$2 \times 15 \times 36 = 1080 = 2$ ends.
$2 \times 15 \times 50 = \underline{1500} = 2$ sides.
6180 sq. ft. = entire surface of 1st hall.
$30 \times 30 = 900 =$ floor.
$30 \times 30 = 900 =$ ceiling.
$2 \times 30 \times 30 = 1800 =$ ends.
$2 \times 30 \times 30 = \underline{1800} =$ sides.
5400 sq. ft. = entire surface of 2d hall.
6180 sq. ft. − 5400 sq. ft. = 780 sq. ft., Difference.
780×5¢ = \$39. *Ans.*

SIMILAR SURFACES AND VOLUMES.

PAGE 281.

(2.) $\overline{40}^2 : \overline{100}^2 :: \$200 : x$
$1600 : 10000 :: \$200 : x$

$$\frac{10000 \times \$200}{1600} = \$1250.$$

(3.) $\overline{10}^2 : \overline{50}^2 :: 78.54 : x$
$100 : 2500 :: 78.54 : x$

$$\frac{2500 \times 78.54}{100} = 1962.50.$$

(4.) $1^2 : 24^2 :: 1$ gal. $: x$
$1 : 576 :: 1$ gal. $: x$

$$\frac{576 \times 1 \text{ gal.}}{1} = 576 \text{ gal., in 40 sec., or } \tfrac{2}{3} \text{ min.}$$

$\frac{1}{3}$ min. $= \frac{1}{2}$ of 576 gal. $= 288$ gal.
$\frac{3}{3}$ " $= 3 \times 288$ gal. $= 864$ gal.

(5.) $\overline{200}^2 : \overline{25}^2 : : \$1920 : x$

$40000 : 625 : : \$1920 : x$

$$\frac{625 \times \$1920}{40000} = \$30.$$

(7.) $2^3 : 6^3 : : 5 \text{ lb.} : x$

$8 : 216 : : 5 \text{ lb.} : x$

$$\frac{216 \times 5 \text{ lb.}}{8} = 135 \text{ lb.}$$

PAGE 282.

(8.) $6^3 : 5^3 : : 180 \text{ lb.} : x$

$216 : 125 : : 180 \text{ lb.} : x$

$$\frac{125 \times 180 \text{ lb.}}{216} = 104\tfrac{1}{6} \text{ lb.}$$

(9.) $(\frac{1}{2})^2 : (\frac{5}{2})^2 : : 1 \text{ lb.} : x$

$\frac{1}{4} : \frac{25}{4} : : 1 \text{ lb.} : x$

$$\frac{\frac{25}{4} \times 1 \text{ lb.}}{\frac{1}{4}} = 25 \text{ lb.}$$

(10.) $3^3 : 3 \times (2)^3 : : \text{1st apple} : x$

$27 : 24 : : \text{1st apple} : x$

$$\frac{24 \times \text{1st apple}}{27} = \tfrac{8}{9} \text{ First apple.}$$

Hence, 3 apples 2 inches in diameter equal $\frac{8}{9}$ of 1 apple 3 inches in diameter.

ARITHMETICAL PROGRESSION.

PAGE 283.

(3.) $l = a + (n-1)d$

$l = 5 + (30-1)4$

$= 5 + 29 \times 4$

$= 5 + 116 = 121.$

(4.) $a = l - (n-1)d$

$a = 147 - (36-1)3$

$= 147 - 35 \times 3$

$= 147 - 105 = 42.$

PAGE 284.

(5.) $l=a-(n-1)d$

$l=200-(64-1)3$

$=200-63\times 3$

$=200-189=11.$

(6.) $a=l+(n-1)d$

$a=6\frac{1}{2}+(100-1)\frac{1}{2}$

$=6\frac{1}{2}+99\times\frac{1}{2}$

$=6\frac{1}{2}+49\frac{1}{2}=56.$

(7.) $l=a+(n-1)d$

$l=200+(300-1)\frac{1}{2}$

$=200+299\times\frac{1}{2}$

$=200+149\frac{1}{2}=349\frac{1}{2}.$

(8.) $l=a+(n-1)d$

$l=420+(119-1)12$

$=420+118\times 12$

$=420+1416=1836.$

CASE II.

(1.) $(n-1)d=l-a$

$7d=28-7=21$

$d=\frac{1}{7}$ of $21=3.$

(2.) $(117-1)d=30-1$

$116d=29$

$d=\frac{1}{116}$ of $29=\frac{1}{4}.$

(3.) $(26-1)d=\$1375-\$500$

$25d=\$875$

$d=\frac{1}{25}$ of $\$875=\$35$

$35\div 500=7\%.$

(4.) $(6-1)d=\$8000-\$5000$

$5d=\$3000$

$d=\$600.$

PAGE 285.

(5.) $12d=\$1400-\$500=\$900$

$1d=\frac{1}{12}$ of $\$900=\$75.$

(6.) $(n-1)d=45-3$

$(n-1)3=42$

$3n-3=42$

$3n=42+3=45$

$n=\frac{1}{3}$ of $45=15.$

(7.) $$\left.\begin{array}{l}125-17=108\\108\div 6=18\\18+1=19.\ \textit{Ans.}\end{array}\right\}\text{ or }\left\{\begin{array}{l}125-17=108\\108=d(n-1)\\\qquad=6(n-1)=6n-6\\108+6=114=6\,n\\\qquad\qquad n=\tfrac{1}{6}\text{ of }114=19.\end{array}\right.$$

(8.) $13560-6000=7560$
6% of $6000=360$
$7560\div 360=21$. *Ans.*

(9.) $1500-300=1200$
$1200\div 75=16$. *Ans.*

PAGE 286.

(2.) $\text{S.}=(a+l)\frac{n}{2}$
$=(5+149)\frac{25}{2}$
$=154\times\frac{25}{2}=1925$. *Ans.*

(3.) $\text{S.}=(a+l)\frac{n}{2}$
$=(1+12)\frac{12}{2}$
$=13\times 6=78$. *Ans.*

(4.) 7 days = 14 half days.
$14\times 78=1092$. *Ans.* See Problem 3, above.

(5.) $13-10=3=d$
$l=a+(n-1)d$
$=10+9\times 3=37$
$\text{S.}=(a+l)\frac{n}{2}$
$=(10+37)\frac{10}{2}$
$=47\times 5=235$. *Ans.*

(6.) $l=a+(n-1)d$
$=600+9\times 150$
$=600+1350=1950$
$\text{S.}=(a+l)\frac{n}{2}$
$=(600+1950)\frac{10}{2}$
$=2550\times 5=12750$. *Ans.*

INTEREST ON DEFERRED PAYMENTS.

CASE I.—PAGE 287.

(2.) 3 yr. = 36 mo.

$300 per. annum = $25 monthly

$$\frac{36 \times 37}{4} \times 25 = 8325, \text{ or } \$83.25, \text{ Int.}$$

(3.) $\frac{1}{12}$ of $240 = $20, Monthly payment.

5 yr. = 60 mos.

$$\frac{60 \times 61}{4} \times 20 = 18300, \text{ Int. at } 6\%.$$

$\frac{7}{6} \times \$183 = \$213.50$, Int. at 7%.

5 × $240 = 1200.00, Rent.

$1413.50, Amount due.

(4.) 4 yr. = 48 mo.

$$\frac{48 \times 49}{4} = 588, \text{ Int.}$$

$48 + $5.88 = $53.88. *Ans.*

(5.) 9 yr. = 108 mo.

$$\frac{108 \times 109}{4} = 2943, \text{ Int.}$$

$108 + $29.43 = $137.43, Value.

(6.) 6 yr. 3 mo. = 75 mo.

$$\frac{75 \times 76}{4} = 1425, \text{ Int.}$$

$75 + $14.25 = $89.25, Value per share.

15 × $89.25 = $1338.75, Value of 15 shares.

(7.) 6 yr. = 72 mo.

$$\frac{72 \times 73}{4} = 1314, \text{ Int. at } 6\%.$$

$\frac{10}{6} \times \$13.14 = \$2190$, Int. at 10%.

$72 + $21.90 = $93.90, Value.

CASE II.—PAGE 288.

(2.) \$300 annually = \$75 quarterly.
3 yrs. = 12 quarters.

$$\begin{array}{ll}\frac{12\times13\times3}{4}\times75 & =\$87.75\text{, Int.}\\ 3\times\$300 & =\underline{900.00}\text{, Rent.}\\ & \ \ \$987.75\quad \textit{Ans.}\end{array}$$

(3.) $\frac{1}{10}$ of \$12000 = \$1200, Annual payment.

$$\begin{array}{ll}\frac{10\times11\times12}{4}\times1200 & =\$3960\text{, Int.}\\ & \ \ \underline{12000}\text{, Prin.}\\ & \ \ \$15960\quad \textit{Ans.}\end{array}$$

(4.) $\frac{1}{5}$ of \$2000 = \$400, Annual payment.

$$\begin{array}{ll}\frac{5\times6\times12}{4}\times400 & =\$360\text{, Int.}\\ & \ \ \underline{2000}\\ & \ \ \$2360\text{, Total.}\end{array}$$

$\frac{1}{20}$ of \$2000 = \$100, Quarterly payment.

$$\begin{array}{ll}\frac{20\times21\times3}{4}\times100 & =\$315\text{, Int.}\\ & \ \ \underline{2000}\\ & \ \ \$2315\text{, Total.}\end{array}$$

\$2360 − \$2315 = \$45. *Ans.*

(5.) $\frac{1}{4}$ of \$350 = \$87$\frac{1}{2}$, Quarterly payment.
4 yrs. = 16 quarters.

$$\begin{array}{ll}\frac{16\times17\times3}{4}\times87\tfrac{1}{2} & =\$178.50\text{, Int.}\\ 4\times\$350 & =\underline{1400.00}\\ & \ \ \$1578.50\quad \textit{Ans.}\end{array}$$

GEOMETRICAL PROGRESSION.

CASE I.—PAGE 290.

(3.) $l = ar^{n-1}$

$l = 5 \times 2^5 = 5 \times 32 = 160.$ *Ans.*

(4.) $a = \dfrac{l}{r^{n-1}}$

$a = \dfrac{2187}{3^4} = \dfrac{2187}{81} = 27.$ *Ans.*

(5.) $a = \dfrac{l}{r^{n-1}}$

$= \dfrac{384}{2^6} = \dfrac{384}{64} = 6.$ *Ans.*

(6.) $729 \div 2187 = \frac{1}{3} = r.$

$l = ar^{n-1}$

$= 2187 \times (\frac{1}{3})^5 = \frac{2187}{243} = 9.$ *Ans.*

(7.) $l = ar^{n-1}$

$= 50 \times (1.06)^5 = 50 \times 1.3382 = 66.91.$ *Ans.*

NOTE.—Number of terms equals 6.

(8.) $l = ar^{n-1}$

$9 \times 32 = 288 = r$

$l = 9 \times \overline{288}^3 = 9 \times 23887872 = 214990848.$

CASE II.—PAGE 291.

(2.) $l = ar^{n-1}$

$= 75 \times 2^4$

$= 75 \times 16 = 1200$

$S = \dfrac{rl - a}{r - 1}$

$= \dfrac{2 \times 1200 - 75}{2 - 1} = \dfrac{2400 - 75}{1} = 2325.$

(3.) $r = 3,\ n = 6$

$$
\begin{aligned}
l &= ar^{n-1} \\
&= 500 \times 3^5 \\
&= 500 \times 243 = 121500 \\
S &= \frac{rl - a}{r - 1} \\
&= \frac{3 \times 121500 - 500}{3 - 1} \\
&= \frac{364500 - 500}{2} = \frac{364000}{2} = 182000.
\end{aligned}
$$

(4.) $n = 9,\ l = ar^{n-1}$

$$
\begin{aligned}
l &= \$50 \times (1.06)^9 \\
&= \$50 \times 1.5938+ = \$79.69+.
\end{aligned}
$$

INFINITE SERIES, PAGE 292.

(2.) $r = \frac{1}{5};\ \frac{a}{1-r} = \frac{3}{1-\frac{1}{5}} = \frac{3}{\frac{4}{5}} = 3 \times \frac{5}{4} = \frac{15}{4} = 3\frac{3}{4}.$ *Ans.*

(3.) $r = \frac{1}{4};\ \frac{a}{1-r} = \frac{2}{1-\frac{1}{4}} = \frac{2}{\frac{3}{4}} = 2 \times \frac{4}{3} = \frac{8}{3} = 2\frac{2}{3}.$ *Ans.*

(4.) $r = \frac{60}{100} = \frac{3}{5};\ \frac{a}{1-r} = \frac{100}{\frac{2}{5}} = 100 \times \frac{5}{2} = \frac{500}{2} = 250.$ *Ans.*

ANNUITIES AT SIMPLE INTEREST.

CASE I.—PAGE 293.

(2.) $\frac{19 \times 20 \times 12}{4} \times 400 = \$4560$, Int.

$\frac{5}{6}$ of \$4560 = \$3800, Int. at 5%.

$20 \times 400 =$ 8000, Annuity.

\$11800, Final value.

(3.) $\frac{14 \times 15 \times 12}{4} \times 300 = \$1890$, Int.

$15 \times 300 = \underline{4500}$, Annuity.

$6390, Final value.

Case II.—Page 294.

(2.) $\frac{9 \times 10 \times 12}{4} \times 500 = \$1350$, Int.

$10 \times 500 = \underline{5000}$, Annuity.

$6350, Final value.

Amt. of $1 for 10 yr. at 6% = $1.60

$\$6350 \div 1.60 = \$3968.75$. *Ans.*

(3.) $\frac{24 \times 25 \times 12}{4} \times 1200 = \$21600$, Int.

$25 \times \$1200 = \underline{30000}$, Annuity,

$51600, Final value.

Amt. of $1 for 25 yr. at 6% = $2.50

$\$51600 \div 2.50 = \$20640$. *Ans.*

(4.) $\frac{15 \times 16 \times 12}{4} \times 300 = \$2160$, Int.

$16 \times 300 = \underline{4800}$, Annuity.

$6960, Final value.

Amt. of $1 for 16 yr. at 6% = $1.96

$\$6960 \div 1.96 = \$3551.02$. *Ans.*

(5.) $18000 \div 1500 = 12$, No. payments.

$\frac{11 \times 12 \times 12}{4} \times 1500 = \$5940$, Int.

$\underline{18000}$, Annuity.

$23940, Final value.

Amt. of $1 for the time $1.72

$\$23940 \div 1.72 = \$13918.60$. *Ans.*

(6.) $\frac{1}{12}$ of $\$300=\$25$, Monthly payment.

$$\frac{12\times13}{4}\times25=\ \$9.75,\ \text{Int.}$$

$$\text{Rent}\qquad=\underline{300.00}$$

$$\$309.75,\ \text{Final value.}$$

$\$309.75\div1.06=\$292.22.$ *Ans.*

ANNUITIES AT COMPOUND INTEREST.

Case I.—Page 295.

(2.)

$$\$1\times(1.04)^5=\$1.2167$$

$$\frac{\$1.2167\times1.04-\$1}{.04}=\frac{\$1.2653-\$1}{.04}=\frac{\$.2653}{.04}=\$6.6325.$$

$300\times\$6.6325=\$1989.75.$ *Ans.*

(3.)

$$\$1\times(1.05)^9=\$1.5513$$

$$\frac{\$1.5513\times1.05-\$1}{.05}=\frac{\$1.6289-\$1}{.05}=\frac{\$.6289}{.05}=\$12.578.$$

$600\times\$12.578=\$7546.80.$ *Ans.*

(4.)

$$\$1\times(1.07)^9=\$1.8385$$

$$\frac{\$1.8385\times1.07-\$1}{.07}=\frac{\$1.9672-\$1}{.07}=\frac{\$.9689}{.07}=\$13.8414$$

$\$123.90\times13.8414=\$1714.949.$ *Ans.*

(5.)

$$\$1\times(1.03)^{19}=\$1.7535$$

$$\frac{\$1.7535\times1.03-\$1}{.03}=\frac{\$1.8061-\$1}{.03}=\frac{\$.8061}{.03}=\$26.87$$

$50\times\$26.87=\$1343.50.$ *Ans.*

CASE II.

(1.)

$\$1 \times (1.06)^6 = \$1.4185$

$$\frac{\$1.4185 \times 1.06 - \$1}{.06} = \frac{\$1.5036 - \$1}{.06} = \frac{\$.5036}{.06.} = \$8.39\frac{1}{3}$$

$200 \times \$8.39\frac{1}{3} = \$1678.67$, Final value.

$\$1678.67 \div 1.5036 = \$1116.43$. *Ans.*

NOTE.—\$1.5036 is the amount of \$1 for 7 yr. at 6% comp. int.

(2.)

$\$1 \times (1.05)^{14} = \$1.9799$

$$\frac{\$1.9799 \times 1.05 - \$1}{.05} = \frac{\$2.0789 - \$1}{.05} = \frac{\$1.0789}{.05} = \$21.558$$

$500 \times \$21.558 = \$10789$

$\$10789 \div 2.0789 = \$5189.76$. *Ans.*

(3.)

$\$1 \times (1.04)^{11} = \$1.5395$

$$\frac{\$1.5395 \times 1.04 - \$1}{.04} = \frac{\$1.6010 - \$1}{.04} = \frac{\$.6010}{.04} = \$15.025$$

$100 \times \$15.025 = \$1502.50$

$\$1502.50 \div 1.6010 = \$938.48$.

(4.)

$\$1 \times (1.04)^{13} = \$1.6651$

$$\frac{\$1.6651 \times 1.04 - \$1}{.04} = \frac{\$1.7317 - \$1}{.04} = \frac{\$.7317}{.04} = \$18.2925$$

$600 \times \$18.2925 = \$10975.50$

$\$10975.50 \div 1.7317 = \$6337.99$. *Ans.*

CIRCULATING DECIMALS.

PAGE 297.

(1.) $.\dot{3} = \frac{3}{9} = \frac{1}{3}$.

(2.) $.\dot{6} = \frac{6}{9} = \frac{2}{3}$.

(3.) $.\dot{2}\dot{1} = \frac{21}{99} = \frac{7}{33}$.

(4.) $.\dot{7}5\dot{3} = \frac{753}{999} = \frac{251}{333}$.

(5.) $.\dot{5}3\dot{1} = \frac{531}{999} = \frac{59}{111}$.

(6.) $.\dot{8}23\dot{2} = \frac{8232}{9999} = \frac{2744}{3333}$.

(7.) $.\dot{8}5\dot{2} = \frac{852}{999} = \frac{284}{333}$.

(8.) $.\dot{5}2\dot{7} = \frac{527}{999}$.

(9.) $.\dot{0}4\dot{8} = \frac{48}{999} = \frac{16}{333}$.

(10.) $.\dot{0}00\dot{3} = \frac{3}{9999} = \frac{1}{3333}$.

(11.)
$$\begin{array}{r@{\;}l}
10000\ R = & 2564.64,\ \text{etc.} \\
100\ R = & \ \ \ 25.64,\ \text{etc.} \\
\hline
9900\ R = & 2539 \\
R = & \frac{2539}{9900}.\quad \textit{Ans.}
\end{array}$$

(12.)
$$\begin{array}{r@{\;}l}
100000\ R = & 35135.135,\ \text{etc.} \\
100\ R = & \ \ \ \ \ \ 35.135,\ \text{etc.} \\
\hline
99900\ R = & 35100 \\
R = & \frac{35100}{99900} = \frac{13}{37}.\quad \textit{Ans.}
\end{array}$$

(13.)
$$\begin{array}{r@{\;}l}
10000\ R = & 2297.297,\ \text{etc.} \\
10\ R = & \ \ \ \ \ \ 2.297,\ \text{etc.} \\
\hline
9990\ R = & 2295 \\
R = & \frac{2295}{9990} = \frac{17}{74}.\quad \textit{Ans.}
\end{array}$$

(14.)
$$\begin{aligned} 10000\,\text{R} &= 4306.306, \text{ etc.} \\ 10\,\text{R} &= 4.306, \text{ etc.} \\ \hline 9990\,\text{R} &= 4302 \\ \text{R} &= \tfrac{4302}{9990} = \tfrac{717}{1665}. \quad \textit{Ans.} \end{aligned}$$

(15.)
$$\begin{aligned} 100000\,\text{R} &= 84234.234, \text{ etc.} \\ 100\,\text{R} &= 84.234, \text{ etc.} \\ \hline 99900\,\text{R} &= 84150 \\ \text{R} &= \tfrac{84150}{99900} = \tfrac{187}{222}. \quad \textit{Ans} \end{aligned}$$

(16.) $.\dot{5}9\dot{4} = \frac{594}{999} = \frac{22}{37}$. *Ans.*

(17.)
$$\begin{aligned} 100000\,\text{R} &= 7209.209, \text{ etc.} \\ 100\,\text{R} &= 7.209, \text{ etc.} \\ \hline 99900\,\text{R} &= 7202 \\ \text{R} &= \tfrac{7202}{99900} = \tfrac{3601}{49950}. \quad \textit{Ans.} \end{aligned}$$

(18.) $.\dot{0}000\dot{3} = \frac{3}{99999} = \frac{1}{33333}$. *Ans.*

(19.) $9.32\dot{0}\dot{9}$
$$\begin{aligned} 10000\,\text{R} &= 3209.09, \text{ etc.} \\ 100\,\text{R} &= 32.09, \text{ etc.} \\ \hline 9900\,\text{R} &= 3177 \\ \text{R} &= \tfrac{3177}{9900} = \tfrac{353}{1100} \end{aligned}$$

Hence, $9.32\dot{0}\dot{9} = 9\frac{353}{1100}$. *Ans.*

(20.) $18.63\dot{7}\dot{5}$

$$10000\ R = 6375.75, \text{ etc.}$$
$$100\ R = 63.75, \text{ etc.}$$
$$9900\ R = 6312$$
$$R = \frac{6312}{9900} = \frac{526}{825}$$

Hence, $18.63\dot{7}\dot{5} = 18\frac{526}{825}$. *Ans.*

DUODECIMALS.

ADDITION AND SUBTRACTION.

PAGE 298.

(3.) 7 ft. 1′ 3″ 6‴
1 ft. 0′ 3″ 6‴ 1⁗
7 ft. 8′ 7″ 0‴ 9⁗
8 ft. 10′ 6″
24 ft. 8′ 8″ 0‴ 10⁗ *Ans.*

(4.) 18 ft. 0′ 3″ 0‴ 9⁗
10 ft. 2′ 2″ 6‴
7 ft. 10′ 0″ 6‴ 9⁗ *Ans.*

MULTIPLICATION OF DUODECIMALS.

PAGE 298.

(2.)
15 ft. 8′
16 ft. 3′
3 ft. 11′
250 ft. 8′
254 ft. 7′

(3.)

$$\begin{array}{rrr}
18 \text{ ft.} & 3' & \\
15 \text{ ft.} & 2' & \\
\hline
3 \text{ ft.} & 0' & 6'' \\
273 \text{ ft.} & 9' & \\
\hline
276 \text{ ft.} & 9' & 6'' = \text{Ceiling.} \\
\hline
18 \text{ ft.} & 3' & \\
9 \text{ ft.} & 7' & \\
\hline
10 \text{ ft.} & 7' & 9'' \\
164 \text{ ft.} & 3' & \\
\hline
174 \text{ ft.} & 10' & 9'' \\
 & & 2 \\
\hline
349 \text{ ft.} & 9' & 6'' = \text{Two sides.} \\
\hline
15 \text{ ft.} & 2' & \\
9 \text{ ft.} & 7' & \\
\hline
8 \text{ ft.} & 10' & 2'' \\
136 \text{ ft.} & 6' & \\
\hline
145 \text{ ft.} & 4' & 2'' \\
 & & 2 \\
\hline
290 \text{ ft.} & 8' & 4'' = \text{Two ends.}
\end{array}$$

$$\begin{array}{rr}
10 \text{ ft.} & 3' \\
 & 8' \\
\hline
9 \text{ ft.} & 7'
\end{array}$$

$$\begin{array}{rrr}
276 \text{ ft.} & 9' & 6'' \\
349 \text{ ft.} & 9' & 6'' \\
290 \text{ ft.} & 8' & 4'' \\
\hline
917 \text{ ft.} & 3' & 4''
\end{array} \quad \textit{Ans.}$$

Page 299.

(4.)

$$\begin{array}{rrrr}
2 \text{ ft.} & 3' & 6'' & \\
 & 3 \text{ ft.} & 2' & \\
\hline
 & 4' & 7'' & \\
6 \text{ ft.} & 10' & 6'' & \\
\hline
7 \text{ ft.} & 3' & 1'' & \\
 & 4 \text{ ft.} & 2' & \\
\hline
1 \text{ ft.} & 2' & 6'' & 2''' \\
29 \text{ ft.} & 0' & 4'' & \\
\hline
30 \text{ ft.} & 2' & 10'' & 2'''
\end{array}$$

(5.)

$$\begin{array}{rrr}
2 \text{ ft.} & 3' & 6'' \\
 & 3 \text{ ft.} & 2' \\
\hline
 & 4' & 7'' \\
6 \text{ ft.} & 10' & 6'' \\
\hline
7 \text{ ft.} & 3' & 1'' \\
 & & 2 \\
\hline
14 \text{ ft.} & 6' & 2'' = \text{Two sides.} \\
\hline
2 \text{ ft.} & 3' & 6'' \\
 & 4 \text{ ft.} & 2' \\
\hline
 & 4' & 7'' \\
9 \text{ ft.} & 2' & \\
\hline
9 \text{ ft.} & 6' & 7'' \\
 & & 2 \\
\hline
19 \text{ ft.} & 1' & 2'' = \text{Two ends.}
\end{array}$$

14 ft. 6′ 2″
19 ft. 1′ 2″
26 ft. 4′ 8″
60 sq. ft. *Ans.*

3 ft. 2′
4 ft. 2′
6′ 4″
12 ft. 8′
13 ft. 2′ 4″
2
26 ft. 4′ 8″ = Top and bottom.

DIVISION OF DUODECIMALS.

PAGE 299.

(2.) 10 ft. 6′) 216 ft. 5′ 10″ 16‴ (20 ft. 7′ 5″
210
6 ft. 5′ 10″
6 ft. 1′ 6″
4′ 4″ 6‴
4′ 4″ 6‴

(3.) 5 ft. 4′
3 ft. 10′
4 ft. 5′ 4″
16 ft.
20 ft. 5′ 4″) 112 ft. 5′ 4″ (5 ft. 6′
102 ft. 2′ 8″
10 ft. 2′ 8″ 0‴
10 ft. 2′ 8″ 0‴

(4.) 12 ft. 6′) 26 ft. 6″ (2 ft. 1′
25 ft.
1 ft. 0′ 6″
1 ft. 0′ 6″

(5.)

$$\begin{array}{l}
20\text{ ft. }2' \\
\qquad\quad 5' \\
\hline
8\text{ ft. }4'\ 10''\,\big)\,14\text{ ft. }0'\ \ 0''\ 8'''\,\big(\,1\text{ ft. }8' \\
\qquad\qquad\qquad\ \ 8\text{ ft. }4'\ 10'' \\
\qquad\qquad\qquad\ \ \overline{5\text{ ft. }7'\ \ 2''\ 8'''} \\
\qquad\qquad\qquad\ \ 5\text{ ft. }7'\ \ 2''\ 8'''
\end{array}$$

MEASUREMENTS.

TRIANGLES.—PAGE 301.

(2.) $\frac{30\text{ ft.}\times 12\frac{1}{2}\text{ ft.}}{2} = 187\frac{1}{2}$ sq. ft.

(3.) $\frac{920\text{ ft.}\times 816\text{ ft.}}{2} = 375360$ sq. ft. $= 8$ A. 98 P. $119\frac{1}{2}$ sq. ft.

(4.) $\frac{25\text{ ft.}\times 8\frac{1}{4}\text{ ft.}}{2} = 103\frac{1}{8}$ sq. ft. $= 1$ gable.

$$\begin{array}{l}
\quad 2 \\
\hline
206\frac{1}{4}\text{ sq. ft.} = 2\text{ gables.}
\end{array}$$

$206\frac{1}{4}\times \$.06 = \$12.37\frac{1}{2}$, Cost of painting.

PAGE 302.

(2.) $\frac{60+60+60}{2} = 90 =$ half sum.

$90 - 60 = 30$

$90 - 60 = 30$

$90 - 60 = 30$

$30\times 30\times 30\times 90 = 2430000$

$\sqrt{2430000} = 1559 -$ sq. ft.

(3.) $\frac{40+60+50}{2}=75=$ half sum.

$75-40=35$

$75-60=15$

$75-50=25$

$35\times15\times25\times75=984375$

$\sqrt{984375}$ sq. rd. $=992.16$ P. $=6$ A. 32.16 P.

PAGE 303.

(2.) $\overline{500}^2+\overline{700}^2=250000+490000=740000$

$\sqrt{740000}=860+$. *Ans.*

(3.) $\overline{40}^2+\overline{30}^2=1600+900=2500$

$\sqrt{2500}=50$. *Ans.*

(4.) $\frac{1}{2}$ of 30 ft. = 15 ft. = $\frac{1}{2}$ width.

$\overline{15}^2+8^2=225+64=289$

$\sqrt{289}=17$

17 ft. + 2 ft. = 19 ft. *Ans.*

(5.) $\overline{12}^2+\overline{10}^2=144+100=244$

$\sqrt{244}=15.6205-$

$72\times15.6205-$ mi. $=1124.67+$ mi. *Ans.*

PAGE 303.

(2.) $\overline{250}^2-\overline{200}^2=62500-40000=22500$

$\sqrt{22500}=150$

150 ft. + 5 ft. = 155 ft.

(3.) $\overline{800}^2-\overline{620}^2=640000-384400=255600$

$\sqrt{255600}=505.57$. *Ans.*

(4.) $\frac{1}{2}$ of 30 ft. = 15 ft. = base.

$20-2=18=$ hypothenuse.

$\overline{18}^2-\overline{15}^2=324-225=99$

$\sqrt{99}=9.95$. *Ans.*

(5.) $\overline{18}^2+\overline{15}^2+\overline{10}^2=324+225+100=649$

$\sqrt{649}=25.475$. *Ans.*

Note.—The same problem may be solved by taking the sum of the squares of 18 and 15, and extracting the square root; then squaring this result and 10, and finding the square root; but the method above given is much shorter and avoids repetition.

QUADRILATERALS.—Page 305.

(1.) $15\times9\frac{1}{2}=142\frac{1}{2}$. *Ans.*

(2.) $\frac{12+10}{2}=11=\frac{11}{12}$ ft.; 16 ft. $\times\frac{11}{12}$ ft. $=\frac{192}{12}$ sq. ft. $=$ $14\frac{2}{3}$ sq. ft.

(3.) $\frac{720+600}{2}=\frac{1320}{2}=660$; 660 ft. $\times$ 900 ft. $=594000$ sq. ft.

$594000\div43560=13\frac{7}{11}$, No. of acres.

(4.) Divide the field into two triangles, the sides of the first being 30, 40, and 50 ft. respectively, and of the second 60, 70, and 50 ft. respectively.

1st.	2d.
$\frac{30+40+50}{2}=60$	$\frac{60+70+50}{2}=90$
$60-30=30$	$90-60=30$
$60-40=20$	$90-70=20$
$60-50=10$	$90-50=40$
$30\times20\times10\times60=360000$	$30\times20\times40\times90=2160000$
$\sqrt{360000}=600$.	$\sqrt{2160000}=1469.7$

600 P. + 1469.7 P. = 2069.7 P. = 12 A. 149.7 P.

CIRCLES.—Page 306.

(1.) 3.1416×25 ft. $=78.54$ ft. *Ans.*

(2.) $12.5664\div3.1416=4$. *Ans.*

(3.) 1 mile = 5280 ft.
$5280 \div 3.1416 = 1680.67$. *Ans.*

(4.) $5280 \div 3.1416 = 1680.67$, Diameter.
$\frac{5280 \times 1680.67+}{4} = 2218487.4- = 50$ A. 148 P. 194.4 ft. *Ans.*

(5.) $\frac{1}{2}$ of 5280 ft. = 2640 ft.
Diameter $= 2640 \div 3.1416 = 840.3861+$
$\frac{2640 \times 840.3861}{4} = 554621.9+ = 12$ A. 117 P. 48.6 sq. ft.

(6.) $\overline{100\text{ ft.}}^2 \times 3.1416 = 10000$ sq. ft. $\times 3.1416 = 31416$ sq. ft.

(7.) 3 ft. × .7071 = 2.1213 ft. = 2.1213 × 12 in. = 25.4556 in.

(8.) 18 in. × .7071 = 12.7278 in.

VOLUMES.—PAGE 307.

(1.) 3.1416 × 30 in. = 94.2480 in. = 7.854 ft.
10 × 7.854 = 78.54. *Ans.*

(2.) 20 ft. × 2 ft. = 40 sq. ft.; 2 × 40 sq. ft. = 80 sq. ft.
20 ft. × $1\frac{1}{2}$ ft. = 30 sq. ft.; 2 × 30 sq. ft. = 60 sq. ft.
2 ft. × $1\frac{1}{2}$ ft. = 3 sq. ft.; 2 × 3 sq. ft. = 6 sq. ft.
146 sq. ft. *Ans.*

(3.) 12 in. + 15 in. + 18 in. = 45 in. = $3\frac{3}{4}$ ft.
12 ft. × $3\frac{3}{4}$ ft. = 45 sq. ft.

(4.) 40 in. × 3.1416 = 125.664 in. = 10.472 ft., Circle.
30 ft. × 10.472 ft. = 314.16 sq. ft., Convex surface.
10.472 ft. × $\frac{5}{6}$ ft. = $8.7266\frac{2}{3}$ sq. ft., Area of 1 end.
2 × $8.7266\frac{2}{3}$ sq. ft. = 17.4533 sq. ft., Area of 2 ends.
314.16 sq. ft. + 17.4533 sq. ft. = 331.6133 sq. ft. *Ans.*

(5.) $6 \times 2\frac{1}{2} = 15$, No. sq. ft. in 1 side.
$4 \times 15 = 60$, " " 4 sides.
$2\frac{1}{2} \times 2\frac{1}{2} = 6\frac{1}{4}$, " " 1 end.
$2 \times 6\frac{1}{4} = 12\frac{1}{2}$ " " 2 ends.
$60 + 6\frac{1}{4} = 66\frac{1}{4}$
$66\frac{1}{4} \times 5$¢ $= \$3.31\frac{1}{4}$. *Ans.*

(6.) 18 in. $= 1\frac{1}{2}$ ft.; 15 in. $= 1\frac{1}{4}$ ft.
$1\frac{1}{2} \times 1\frac{1}{4} = 1\frac{7}{8}$.
60 ft. $\times 1\frac{7}{8}$ sq. ft. $= 112\frac{1}{2}$ cu. ft.

(7.) $(2\frac{1}{2})^2 = \frac{25}{4}$
$\frac{25}{4} \times .785398 = 4.908737 +$
$30 \times 4.908737 + = 147.2621 +$. *Ans.*

Page 308.

(8.) 24 in. = 2 ft.; $2^2 = 4$
$4 \times .785398 = 3.141592$
$50 \times 3.141592 = 157.1796$
$157.1796 \times \$.20 = \$31.416$. *Ans.*

(9.) $\overline{30}^2 \times .785398 = 900 \times .785398 = 706.8582$, Area of base.
$20 \times 706.8582 = 14137.164$, Contents in feet.
$1728 \times 14137.164 = 24429019.392$, Contents in in.
$24429019.392 \div 231 = 105753.3$. *Ans.*

PYRAMIDS AND CONES.—Page 309.

(1.) $40 \times \frac{60}{2} = 1200$. *Ans.*

(2.) $8 \times 8 = 64$, Perimeter.
$64 \times \frac{80}{2} = 2560$, Convex surface.
$2560 \times \$.05\frac{1}{2} = \$140.80$. *Ans.*

(3.) $4 \times 5 = 20$, Perimeter of base.
$20 \times \frac{8}{2} = 80$, Convex surface.
$5 \times 5 = 25$, Area of base.
$80 + 25 = 105$, Entire surface.

(4.) $764 \times 764 = 583696$, Area of base.
$\frac{480}{3} \times 583696 = 93{,}391{,}360$. *Ans.*

(5.) 20 in. $= 1\frac{2}{3}$ ft. $= \frac{5}{3}$ ft.
$\frac{5}{3} \times \frac{5}{3} = \frac{25}{9}$, Area of base.
$\frac{20}{3} \times \frac{25}{9} = \frac{500}{27}$, Contents in cu. ft.
$\frac{500}{27} \times \$2.25 = \$41.67$. *Ans.*

(6.) 3.1416×5 ft. $= 15.7080$ ft., Lower perimeter.
3.1416×4 ft. $= \underline{12.5664}$ ft., Upper "
28.2744 ft., Sum of perimeters.
$\frac{6}{2} \times 28.2744 = 84.8232$. *Ans.*

(7.) 4×20 in. $= 6\frac{2}{3}$ ft., Upper perimeter.
4×30 " $= \underline{10}$ ft., Lower "
$16\frac{2}{3}$ ft., Sum.
$\frac{10}{2}$ ft. $\times 16\frac{2}{3}$ ft. $= 83\frac{1}{3}$ sq. ft. *Ans.*

(8.) 8 in. $= \frac{2}{3}$ ft.
20 in. $= \frac{5}{3}$ ft.
$(\frac{2}{3})^2 = \frac{4}{9}$
$(\frac{5}{3})^2 = \frac{25}{9}$
$\frac{4}{9} \times \frac{25}{9} = \frac{100}{81}$
$\sqrt{\frac{100}{81}} = \frac{10}{9}$
$\frac{4}{9} + \frac{25}{9} + \frac{10}{9} = \frac{39}{9} = \frac{13}{3}$
$\frac{13}{3} \times \frac{20}{3} = \frac{260}{9} = 28\frac{8}{9}$. *Ans.*

(9.) Lower diam. = 16 ft.
Rad. = 8 ft.
$R^2 = 64$
$64 \times 3.1416 = 201.0624$, Area of lower base.
Upper diam. = 12 ft.; Rad. = 6 ft.
$R^2 = 36$
$36 \times 3.1416 = 113.0976$, Area of upper base.
$201.0624 \times 113.0976 = 22739.67489024$
$\sqrt{22739.67489024} = 150.7968$

$$\begin{array}{l} 201.0624 \\ 113.0976 \\ \underline{150.7968} \\ 464.9568 \times \frac{15}{3} = 2324.784. \end{array}$$
Ans.

PAGE 310.

(10.) $R^2 = (\frac{3}{2})^2 = \frac{9}{4}$
$\frac{9}{4} \times 3.1416 = 7.0686$, Area lower base.
$R^2 = 1^2 = 1$
$1 \times 3.1416 = 3.1416$, Area upper base.
$7.0686 \times 3.1416 = 22.20671376$
$\sqrt{22.20671376} = 4.7124$

$$\begin{array}{l} 7.0686 \\ 3.1416 \\ \underline{4.7124} \\ 14.9226 \times \frac{40}{3} = 198.968. \end{array}$$
Ans.

(11.) $6 \times 6 = 36$, Area lower base.
$4 \times 4 = 16$, Area upper base.
$16 \times 36 = 576$
$\sqrt{576} = 24$
$36 + 16 + 24 = 76$
12 ft. = 144 in.
$\frac{144}{3} \times 76 = 3648$, Contents of 1 post.
$20 \times 3648 = 72960$, " 20 posts.
$72960 \div 1728 = 42\frac{2}{9}$ cu. ft. *Ans.*

SPHERES.—PAGE 310.

(1.) $\overline{10}^2 = 100$
$100 \times 3.1416 = 314.16.$ *Ans.*

(2.) $\overline{60}^2 = 3600$
$3600 \times 3.1416 = 11309.76$
$11309.76 \times \$.02 = \$226.1952.$ *Ans.*

(3.) $\overline{30}^2 = 900$
$900 \times 3.1416 = 2827.44$
$\frac{1}{6}$ of $30 = 5 = \frac{1}{6}$ Diam.
$2827.44 \times 5 = 14137.20.$ *Ans.*

(4.) 40 in. − 2 in. (shell) = 38 in.
$\overline{38}^3 = 54872$
$54872 \times .5236 = 28730.9792 =$ cu. in.
$28730.9792 \div 231 = 124.376+ =$ No. gal.

(5.) $\overline{30}^2 = 900$
$\frac{1}{3}$ of $900 = 300$
$\sqrt{300} = 17.32+.$

BOARD MEASURE.—PAGE 311.

(1.) $\frac{16 \times 9}{12} = 12.$ *Ans.*

(2.) $\frac{16 \times 15}{12} = 20$
$12 \times 20 = 240.$ *Ans.*

(3.) $\frac{20 \times 8 \times 4}{12} = 53\frac{1}{3}.$ *Ans.*

(4.)

$$6\times\frac{16\times3\times4}{12}=96$$

$$12\times\frac{18\times3\times8}{12}=432$$

$$12\times\frac{16\times10\times2}{12}=320$$

$$40\times\frac{16\times2\times4}{12}=\underline{427}$$

$$1275$$

$$\frac{1275\times\$15}{1000}=\$19.12.$$ *Ans.*

(5.)

$$150\times\frac{16\times10}{12}=2000$$

$$160\times\frac{12\times12}{12}=1920$$

$$60\times\frac{14\times10\times3}{12}=2100$$

$$60\times\frac{16\times4\times2}{12}=640$$

$$40\times\frac{20\times5\times3}{12}=\underline{1000}$$

$$7660$$

$$\frac{7660\times\$18}{1000}=\$137.88.$$ *Ans.*

PAGE 312.

(6.)

$$120\times\frac{20\times6\times3}{12}=3600;\quad\frac{3600\times\$15}{1000}=\$54.00$$

$$32\times\frac{20\times8\times6}{12}=2560;\quad\frac{2560\times\$16}{1000}=40.96$$

$$120\times\frac{18\times10\times3}{12}=5400;\quad\frac{5400\times\$16}{1000}=86.40$$

$$8\times\frac{24\times8\times8}{12}=1024;\quad\frac{1024\times\$15}{1000}=15.36$$

$$200\times\frac{16\times12}{12}=3200;\quad\frac{3200\times\$22}{1000}=70.40$$

$$150\times\frac{12\times9}{12}=1350;\quad\frac{1350\times\$20}{1000}=27.00$$

$$60\times\frac{14\times2\times8}{12}=1120;\quad\frac{1120\times\$18}{1000}=20.16$$

$$130\times\frac{16\times2\times4}{12}=1386\tfrac{2}{3};\quad\frac{1386\frac{2}{3}\times\$15}{1000}=\underline{20.80}$$

$$\$335.08$$

Ans.

(1.) $18 \times 16 = 288$

$16 \times 12 = \underline{192}$

480

$\frac{1}{2}$ of 40 ft. = 20 ft.

$480 \times 20 = 9600$

$\frac{9600}{12} = 800.$ *Ans.*

(2.) $\frac{1}{4}$ of $60 = 15$

$\overline{15}^2 = 225$

$20 \times 225 = 4500$

$4500 \div 144 = 31\frac{1}{4}$, No. cu. ft.

$31\frac{1}{4} \times \$.02\frac{1}{2} = 78\frac{1}{8}$¢. *Ans.*

STONE WORK.—PAGE 313.

(1.) $80 \times 2\frac{1}{2} \times 10 = 2000$, No. cu. ft.

$2000 \div 24.75 = 80\frac{80}{99}$, No. perches.

(2.) $60 + 60 + 45 + 45 = 210$, No. feet length.

$210 \times 8 \times 1\frac{1}{2} = 2520$, Cu. ft. contents.

$2520 \div 24.75 = 101.818$, No. perches.

$101.818 \times \$2.50 = \$254.54.$ *Ans.*

GRAIN AND HAY.—PAGE 313.

(1.) $10 \times 8 \times 8 = 640$

$640 \times .8 = 512.$ *Ans.*

(2.) $9 \times 9 \times 9 = 729$

$729 \times .8 = 583.2.$ *Ans.*

(3.) $18 \times 3 \times 2 = 108$

$108 \times .08 = 86.4$, No. bu. even meas.

$\frac{4}{5}$ of $86.4 = 69.12$, No. bu. heaped meas.

(4.) $\frac{1}{4}$ of $600 = 150$

$600 + 150 = 750.$ *Ans.*

(5.) $\frac{5}{4}$ of 400 bu. $= 500$ bu. even meas.
$\frac{1}{4}$ of 500 bu. $= 125$ bu.
$500 + 125 = 625$, No. cu. ft.

PAGE 314.

(6.) $10 \times 5 \times 8 = 400$, No. cu. ft.
$12 \times 400 = 4800$, " in 12 bins.
$4800 \times .8 = 3840$, No. of bu.

PAGE 314.

(1.) $30 \times 20 \times 20 = 12000$
$12000 \div 550 = 21\frac{9}{11}$. *Ans.*

(2.) $20 \times 20 \times 15 = 6000$
$6000 \div 450 = 13\frac{1}{3}$. *Ans.*

(3.) $R = 6$
$R^2 = 36$
$36 \times 3.1416 = 113.0976$, Area of base.
$10 \times 113.0976 = 1130.976$, Contents.
$1130.976 \div 550 = 2.0563$, No. tons.
$2.0563 \times \$15 = \$30.84$. *Ans.*

GAUGING.—PAGE 315.

(2.) $\overline{30}^2 = 900$
$900 \times 40 = 36000$
$36000 \times .0034 = 122.4$. *Ans.*

(4.) $29 - 20 = 9$
$\frac{2}{3}$ of $9 = 6$
$20 + 6 = 26 =$ Mean diameter.

$$\frac{20 + 26 + 29}{3} = \frac{75}{3} = 25$$

$(25)^2 = 625$
$20 \times 625 = 12500$
$12500 \times .0034 = 42.5$, No. gals.

GENERAL ANALYSIS.

ORAL EXERCISE.—PAGE 318.

1. The difference between the price of hats at \$5 each and hats at \$3 each is \$2 each. The whole difference in price is \$20; hence, there were as many hats bought as 2 is contained times in 20, or 10 hats.

2. The difference in the price of oranges at 3 cents each and oranges at 6 cents each is 3 cents each. The whole difference in price was the difference between 40 cents and 1 cent, or 39 cents; hence, there were as many oranges as 3 is contained times in 39, or 13.

PAGE 319.

3. The difference in the cost of sheep at \$$4\frac{1}{2}$ each and those at \$6 each is \$$1\frac{1}{2}$ each. The total difference in cost was \$75 and \$15, or \$90; hence, there were as many sheep as \$$1\frac{1}{2}$ is contained times in \$90, or 60.

4. If the boys receive 3 cents apiece and the girls 6 cents apiece, one of each will receive 3 cents and 6 cents, or 9 cents; hence, there are as many of each as 9 is contained times in 90, or 10.

5. *Sug.* One of each cost 2 cents plus 3 cents plus 4 cents, or 9 cents; hence, there were as many of each as 9 is contained times in 72, or 8.

6. If he sold three times as many sheep as pigs, he received 3 times \$4, or \$12, for sheep as often as \$8 for 1 pig; or \$8 and \$12, which are \$20, as often as he sold 1 pig; hence, there were as many pigs sold as 20 is contained times in 120, or 6, and 3 times as many sheep, or 18 sheep.

9. *Sug.* A can do $\frac{1}{6}$ of the work in a day, and B $\frac{1}{5}$; together they can do $\frac{1}{6}$ and $\frac{1}{5}$, or $\frac{11}{30}$.

10. *Sug.* A can do $\frac{1}{3}$ in a day; B, $\frac{1}{4}$; and C, $\frac{1}{6}$; hence, together they can do $\frac{1}{3}$, $\frac{1}{4}$, and $\frac{1}{6}$, or $\frac{45}{60}$, or $\frac{3}{4}$, of the work.

11. If the two together can do the work in 5 hours, in 1 hour they can do $\frac{1}{5}$ of it, and the first alone can do $\frac{1}{9}$ of it; hence, the second can do $\frac{1}{5}$ minus $\frac{1}{9}$, or $\frac{4}{45}$, of the work in an hour. For the second to do the whole work will require as many hours as $\frac{4}{45}$ is contained times in $\frac{45}{45}$, or $11\frac{1}{4}$ hours.

12. *Sug.* Mary can knit $\frac{1}{3}$ of a stocking in $\frac{1}{5}$ of a day, and in $\frac{5}{5}$, or a day, she can knit $\frac{5}{3}$. Ida can knit $\frac{1}{3}$ of a stocking in $\frac{1}{4}$ of a day, and in $\frac{4}{4}$, or a day, she can knit $\frac{4}{3}$; hence, they together can knit $\frac{5}{3}$ and $\frac{4}{3}$, or $\frac{9}{3}$, equal to 3 stockings, in a day. To knit 6 pairs, or 12 stockings, will require as many days as 3 is contained times in 12, or 4 days.

13. *Sug.* Together the three can do $\frac{1}{3}$ of the work in a day. C can do $\frac{1}{9}$ of the work and B $\frac{1}{10}$ of it in a day; hence, B and C together can do $\frac{1}{9}$ plus $\frac{1}{10}$, or $\frac{19}{90}$, in a day, and A can do $\frac{1}{3}$, or $\frac{30}{90}$, minus $\frac{19}{90}$, or $\frac{11}{90}$, in a day. For A to do the whole work will require as many days as $\frac{11}{90}$ is contained times in $\frac{90}{90}$, or $8\frac{2}{11}$ days.

14. *Sug.* A, B, and C together can do $\frac{1}{6}$ of the work in a day, and A and B $\frac{1}{10}$ of it; hence, C can do $\frac{1}{6}-\frac{1}{10}$, or $\frac{1}{15}$, of the work in a day. A and C can do $\frac{1}{8}$ of it in a day; hence, A can do $\frac{1}{8}-\frac{1}{15}$, or $\frac{7}{120}$, of it in a day. If A and B can do $\frac{1}{10}$ of the work, and A alone can do $\frac{7}{120}$ in a day, B can do $\frac{1}{10}-\frac{7}{120}$, which is $\frac{5}{120}$, or $\frac{1}{24}$. If C can do $\frac{1}{15}$ of the work in a day, for him to do the whole work will require 15 days. If B can do $\frac{1}{24}$ of the work in a day, it will require 24 days for him to do the whole of the work. If A do $\frac{7}{120}$ of the work in a day, for him to do the whole of it will require as many days as $\frac{7}{120}$ is contained times in $\frac{120}{120}$, or $17\frac{1}{7}$ days.

PAGE 320.

15. *Sug.* Together they can plough $\frac{1}{3}$ of the field in a week. E can plough $\frac{1}{10}$ in a week, and E and F $\frac{1}{6}$ of it; hence, G can plough $\frac{1}{3}-\frac{1}{6}$, or $\frac{1}{6}$, of it, and F can plough $\frac{1}{6}-\frac{1}{10}$, or $\frac{1}{15}$, of it in a week. If E can plough $\frac{1}{10}$ of it in a week, it will require 10 weeks for him to plough the whole of it. If G can plough $\frac{1}{6}$ of it in a week, it will require 6 weeks for him to plough the whole field. If F can plough $\frac{1}{15}$ of it in a week, it will require 15 weeks for him to plough the whole field.

16. *Sug.* Together they can cut $\frac{1}{3}$ of the wood in a week, and George alone can cut $\frac{1}{8}$; hence, James alone can cut $\frac{1}{3}-\frac{1}{8}$, or $\frac{5}{24}$, of the wood in a week. If George can cut $\frac{1}{8}$ of it in a week, in 3 weeks he can cut 3 times $\frac{1}{8}$, or $\frac{3}{8}$, of it, and there will remain $\frac{5}{8}$ to be cut. James can cut $\frac{5}{24}$ of the wood in a week, and to cut $\frac{5}{8}$, or $\frac{15}{24}$, the remainder, will require as many weeks as $\frac{5}{24}$ is contained times in $\frac{15}{24}$, or 3 weeks.

17. If three persons use a barrel of flour in 10 weeks, they together use $\frac{1}{10}$ of it in a week. The first uses $\frac{1}{40}$ of it in a week, and the second $\frac{1}{25}$ of it in a week; hence, they together use $\frac{1}{40}$ and $\frac{1}{25}$, or $\frac{13}{200}$, of it in a week. The third, therefore, uses $\frac{1}{10}-\frac{13}{200}$, or $\frac{7}{200}$, of it in a week, and to use $\frac{200}{200}$ will require as many weeks as 7 is contained times in 200, or $28\frac{4}{7}$ weeks.

18. If he was to work 30 days for \$45 and board, his wages was \$1.50 a day and board. He lost by his idleness the difference between \$45 and \$30, which is \$15. In one day he lost \$1.50 plus \$1, or \$2.50. He was therefore idle as many days as \$2.50 is contained times in \$15, or 6 days, and worked 30 days minus 6 days, or 24 days.

19. If he was to work 30 days for \$60, his wages was

\$2 a day. Every day he was idle he lost \$2 plus \$1, or \$3. He lost by his idleness \$60 minus \$45, or \$15; hence, he was idle as many days as \$3 is contained times in \$15, or 5 days.

20. If he received \$2 a day, he received each week \$12, and had for his weekly wages \$12 minus \$5, or \$7. Had he worked 20 weeks he would have saved 20 times \$7, or \$140, but he received only \$120; hence, he lost by his idleness \$140 minus \$120, or \$20, and was idle as many days as \$2 is contained times in \$20, or 10 days.

21. 4 times $\frac{5}{6}$ of the number is $\frac{20}{6}$ of the number, and the difference between 5 times the number and $\frac{20}{6}$ of the number, which is $\frac{10}{6}$ of the number, equals 30. If $\frac{10}{6}$ of the number equals 30, $\frac{1}{6}$ of the number is $\frac{1}{10}$ of 30, or 3, and $\frac{6}{6}$, or the number, is 6 times 3, or 18.

22. $\frac{3}{4}$ of the cost of the watch, less \$20, is the cost of the chain, which added to the cost of the watch is $\frac{7}{4}$ of the cost of the watch, less \$20, or the cost of both, which is \$120; hence, $\frac{7}{4}$ of the cost of the watch is \$120 plus \$20, or \$140; $\frac{1}{4}$ of the cost is $\frac{1}{7}$ of \$140, or \$20, and $\frac{4}{4}$, or the cost, is 4 times \$20, or \$80. The cost of the chain is \$120 less \$80, or \$40.

23. If $\frac{3}{4}$ of the cost of the farm, plus \$1200, equals $\frac{2}{3}$ of the cost of the house, $\frac{1}{3}$ of the cost of the house is $\frac{1}{2}$ of $\frac{3}{4}$ of the cost of the farm, plus \$1200, or $\frac{3}{8}$ of the cost of the farm, plus \$600, and $\frac{3}{3}$, or the cost of the house, is three times as much, or $\frac{9}{8}$ of the cost of the farm, plus \$1800, which added to the cost of the farm equals $\frac{17}{8}$ of the cost, plus \$1800, or \$18800; hence, $\frac{17}{8}$ of the cost of the farm equals \$18800 less \$1800, or \$17000. $\frac{1}{8}$ of the cost of the farm is $\frac{1}{17}$ of \$17000, or \$1000, and $\frac{8}{8}$, or the cost, is 8 times \$1000, or \$8000, and the cost of the house is \$18800 less \$8000, or \$10800.

24. If the tail is as long as the head, plus $\frac{1}{4}$ of the body, the tail equals $\frac{1}{4}$ of the body, plus 3 inches, and the head and the tail together equal $\frac{1}{4}$ of the body, plus 6 inches; but the body is as long as the head and the tail; hence, $\frac{4}{4}$, or the body, less $\frac{1}{4}$ of the body, which is $\frac{3}{4}$ of the body, equals 6 inches. $\frac{1}{4}$ of the body is $\frac{1}{3}$ of 6 inches, or 2 inches, and $\frac{4}{4}$, or the body, is 4 times 2 inches, or 8 inches. The tail equals 2 inches plus 3 inches, or 5 inches, and the entire length of the fish is 8 inches plus 5 inches plus 3 inches, or 16 inches.

(25.) *Sug.*

Foundation = 4 ft.
Gable = $\frac{1}{6}$ Body + 4 ft.
Both = $\frac{1}{6}$ Body + 8 ft.
Body = twice as much, or $\frac{1}{3}$ Body + 16 ft.
Hence, Body − $\frac{1}{3}$ Body, or $\frac{2}{3}$ Body = 16 ft.
$\frac{1}{3}$ Body = $\frac{1}{2}$ of 16 ft. = 8 ft.
$\frac{3}{3}$, or Body = 3 times 8 ft. = 24 ft.
Gable = $\frac{1}{6}$ of 24 ft. + 4 ft. = 4 ft. + 4 ft. = 8 ft.
House = 4 ft. + 8 ft. + 24 ft. = 36 ft.

(26.) *Sug.*

From A to B = 50 mi.
From B to C = 50 mi. + $\frac{1}{4}$ dis. from C to D.
From A to C = 100 mi. + $\frac{1}{4}$ dis. from C to D.
From C to D = 3 times (100 mi. + $\frac{1}{4}$ dis. from C to D)
= 300 mi. + $\frac{3}{4}$ dis. from C to D.
Hence, $\frac{4}{4} - \frac{3}{4}$, or $\frac{1}{4}$, dis. from C to D = 300 mi.
$\frac{4}{4}$, or dis. from C to D = 4 × 300 mi. = 1200 mi.
Dis. from A to C = 100 mi. + $\frac{1}{4}$ of 1200 mi. = 400 mi.
Dis. from A to D = 400 mi. + 1200 mi. = 1600 mi.

PAGE 321.

27. If he gave $\frac{3}{4}$ away, he had $\frac{1}{4}$ remaining. $\frac{2}{3}$ of $\frac{1}{4}$ equals $\frac{1}{6}$; hence, he had remaining $\frac{1}{4}$ minus $\frac{1}{6}$, or $\frac{1}{12}$, which equals 5 cents, and $\frac{12}{12}$, or his money, is 12 times 5 cents, or 60 cents.

(28.) *Sug.*

$\frac{2}{3}$ longer $= \frac{3}{4}$ shorter.
$\frac{1}{3}$ longer $= \frac{1}{2}$ of $\frac{3}{4}$, or $\frac{3}{8}$, shorter.
$\frac{3}{3}$, or longer $= 3 \times \frac{3}{8}$ shorter $= \frac{9}{8}$ shorter.
$\frac{8}{8}$ shorter $+ \frac{9}{8}$ shorter $= \frac{17}{8}$ shorter $=$ 51 ft.
$\frac{1}{8}$ shorter $= \frac{1}{17}$ of 51 ft. $=$ 3 ft.
$\frac{8}{8}$, or shorter $=$ 8 times 3 ft. $=$ 24 ft.
51 ft. $-$ 24 ft. $=$ 27 ft. $=$ longer.

(29.) *Sug.*

$\frac{2}{5}$ sec. $= \frac{2}{3}$ first, $+ \$8$.
$\frac{1}{5}$ sec. $= \frac{1}{2}$ of $\frac{2}{3}$ first, $+ \$8$, or $\frac{1}{3}$ first, $+ \$4$.
$\frac{5}{5}$ sec. $=$ 5 times $\frac{1}{3}$ first, $+ \$4 = \frac{5}{3}$ first, $+ \$20$.
$\frac{3}{3}$ first $+ \frac{5}{3}$ first $+ \$20 = \frac{8}{3}$ first, $+ \$20 = \$100$.
$\frac{8}{3}$ first $= \$100 - \$20 = \$80$.
$\frac{1}{3}$ first $= \frac{1}{8}$ of \$80, or \$10.
$\frac{3}{3}$ first $= 3 \times \$10 = \$30$.
$\$100 - \$30 = \$70 =$ second.

30. If the number 60 be divided into 3 plus 2, or 5, equal parts, 3 of the parts, or 36, will represent the number of girls in the school, and 2 parts, or 24, the number of boys. To make the number of girls equal the number of boys there must leave the school 36 girls minus 24 girls, or 12 girls.

31. If there are 2 girls to every 3 boys, there are 20 girls to 30 boys, and in order that there may be 3 girls to 2 boys, there must be 15 times 3 girls, or 45 girls, to 15 times 2 boys, or 30 boys; hence, there must be admitted 45 girls minus 20 girls, or 25 girls.

32. *Sug.* Since there are 10 lbs. of copper, the number of pounds of silver must be 10 times 9 lbs., or 90 lbs., hence, there must be added 90 lbs. – 50 lbs., or 40 lbs., of silver.

33. If he allow $\frac{1}{4}$ of an acre of pasturage and $\frac{2}{5}$ of an acre of corn, he allows for each cow $\frac{1}{4}$ of an acre plus $\frac{2}{5}$ of an acre, or $\frac{13}{20}$ of an acre; hence, he can keep as many cows as $\frac{13}{20}$ is contained times in 39, or 60 cows.

34. If a man pasture 3 cows on an acre, each cow will require $\frac{1}{3}$ of an acre of pasture, and if he feed 1 acre of roots to 5 cows, each cow will require $\frac{1}{5}$ of an acre of roots; hence, each cow will require the produce of $\frac{1}{3}+\frac{1}{5}$, or $\frac{8}{15}$, of an acre of land, and on 40 acres a man can keep as many cows as $\frac{8}{15}$ is contained times in 40, or 75 cows.

35. If a farmer allow 1 acre of grass to every 2 cows, each cow will require $\frac{1}{2}$ an acre of grass; if he allow 1 acre of roots to every 5 cows, each cow will require $\frac{1}{5}$ of an acre of roots; hence, each cow will require the produce of $\frac{1}{2}+\frac{1}{5}$, or $\frac{7}{10}$, of an acre of land, and as many cows can be kept on 35 acres as $\frac{7}{10}$ is contained times in 35, or 50 cows. If he allow $\frac{1}{2}$ an acre of grass to every cow, to 50 cows he will allow 50 times $\frac{1}{2}$ acre, or 25 acres; and if he allow $\frac{1}{5}$ of an acre of roots to every cow, to 50 cows he will allow 50 times $\frac{1}{5}$ of an acre, or 10 acres.

36. If he lost $\frac{3}{4}$ he had $\frac{1}{4}$ remaining. He found $\frac{2}{3}$ of $\frac{1}{4}$, or $\frac{1}{6}$, which added to $\frac{1}{4}$ is $\frac{5}{12}$. $\frac{5}{12}$ of 60 cents equals 25 cents.

Sol. 2d. If he lost $\frac{3}{4}$ of 60 cents, he had $\frac{1}{4}$ of 60 cents, or 15 cents, remaining, and found $\frac{2}{3}$ as much, or 10 cents. He then had 15 cents and 10 cents, or 25 cents.

37. After he found 20 cents, he lost $\frac{1}{2}$ his money and $\frac{1}{2}$ of 20 cents; hence, he had $\frac{1}{2}$ his money and $\frac{1}{2}$ of 20 cents, or 10 cents, remaining. $\frac{1}{2}$ his money, plus 10 cents, equals $\frac{3}{5}$ of his money; hence, the difference between $\frac{3}{5}$ of his

money and $\frac{1}{2}$ of his money, or $\frac{1}{10}$ of his money, is 10 cents, and $\frac{10}{10}$, or his money, is 10 times 10 cents, or 100 cents.

(38.) *Sug.*

$\frac{2}{3}$ No. Ducks $=\frac{3}{4}$ No. Turkeys.
$\frac{1}{3}$ " " $=\frac{1}{2}$ of $\frac{3}{4}$ " " or $\frac{3}{8}$ No. Turkeys.
$\frac{3}{3}$ " " $=3\times\frac{3}{8}$ " " $=\frac{9}{8}$ No. Turkeys.
$\frac{1}{2}$ No. Chickens $=\frac{7}{5}$ No. Turkeys.
$\frac{2}{2}$ " " $=\frac{14}{5}$ " "

$\frac{9}{8}$ No. Turkeys $+\frac{14}{5}$ No. Turkeys $+1$ No. Turkeys $=\frac{197}{40}$ No. Turkeys $=197$.
$\frac{1}{40}$ No. Turkeys $=\frac{1}{197}$ of $197=1$.
$\frac{40}{40}$ No. Turkeys $=40\times1=40$.
$\frac{9}{8}$ No. Turkeys $=\frac{9}{8}$ of $40=45$, No. of Ducks.
$\frac{14}{5}$ No. Turkeys $=\frac{14}{5}$ of $40=112$, No. of Chickens.

PAGE 322.

39. Since 40 dollars is $\frac{2}{5}$ of B's, $\frac{1}{5}$ B's is $\frac{1}{2}$ of 40 dollars, or 20 dollars, and $\frac{5}{5}$, or B's, is 5 times 20 dollars, or 100 dollars. If A gives half his money to B and receives half of B's, he has 20 dollars and 50 dollars, or 70 dollars. If B gives half his money to A and receives half of A's, he has 50 dollars and 20 dollars, or 70 dollars.

40. If he ride 6 miles in one hour and walk but 3 miles an hour, it will take him as many hours to walk as far as he rides in an hour as 3 is contained times in 6, or 2 hours. We divide 10 hours into 2 plus 1, or 3, equal parts. One of these parts, or $\frac{1}{3}$ of 10 hours, which is $3\frac{1}{3}$ hours, is the number of hours he rides. If he rides 6 miles in 1 hour, in $3\frac{1}{3}$ hours he rides $3\frac{1}{3}$ times 6 miles, or 20 miles.

41. The boat sails down the river 8 plus 3, or 11, miles

an hour, and returns at the rate of $8-3$, or 5, miles an hour. To sail 1 mile down requires $\frac{1}{11}$ of an hour, and to sail 1 mile up requires $\frac{1}{5}$ of an hour; hence, to sail 1 mile down and return requires $\frac{1}{11}+\frac{1}{5}$, or $\frac{16}{55}$, of an hour. Therefore, in 8 hours the boat can go and return as many miles as $\frac{16}{55}$ is contained in 8, or $27\frac{1}{2}$ miles.

42. If a man travels by rail 20 miles an hour, to travel 1 mile requires $\frac{1}{20}$ of an hour, and if he travels by boat 12 miles an hour, to travel 1 mile requires $\frac{1}{12}$ of an hour; hence, to travel 1 mile by rail and return by boat requires $\frac{1}{20}+\frac{1}{12}$, or $\frac{2}{15}$, of an hour. Therefore, in 16 hours he can travel as many miles and return as $\frac{2}{15}$ is contained times in 16, or 120 miles.

43. If $\frac{1}{4}$ of the time to midnight equals the time past noon, $\frac{4}{4}$ plus $\frac{1}{4}$, or $\frac{5}{4}$, of the time to midnight equals the time from noon to midnight, or 12 hours. $\frac{1}{4}$ of the time to midnight equals $\frac{1}{5}$ of 12 hours, which is $2\frac{2}{5}$ hours, or 2 hours 24 minutes past noon.

44. *Sug.* $\frac{1}{2}$ the time past noon plus $\frac{2}{2}$ the time past noon, or $\frac{3}{2}$ the time past noon, equals the time from noon to midnight, or 12 hours. Hence, the time is 8 o'clock P. M.

45. *Sug.* The time past midnight minus $\frac{1}{3}$ of the time past midnight equals $\frac{2}{3}$ of the time past midnight, or 12 hours. Hence, $\frac{1}{3}$ equals 6 hours; or the time is 6 o'clock P. M.

46. *Sug.* The time past midnight plus $\frac{1}{2}$ of the time past midnight equals $\frac{3}{2}$ of the time past midnight, or the time from midnight to midnight again, which is 24 hours. Hence $\frac{2}{2}$, or the time past midnight, equals 16 hours; or the time is 4 o'clock P. M.

47. If $\frac{1}{2}$ of the time past midnight equals $\frac{1}{3}$ of the time to noon, $\frac{2}{2}$, or the time past midnight, equals $\frac{2}{3}$ of the time

to noon, which, added to the time to noon, equals $\frac{5}{3}$ of the time to noon, or the time from midnight to noon, which is 12 hours. $\frac{1}{3}$ of the time to noon is $\frac{1}{5}$ of 12 hours, or $2\frac{2}{5}$ hours, and $\frac{2}{3}$, or the time past midnight, is 2 times $2\frac{2}{5}$ hours, or $4\frac{4}{5}$ hours; hence the time is 4 hr. 48 min. A. M.

48. *Sug.* The time past noon equals $\frac{5}{3}$ of the time to noon again; hence $\frac{3}{3}+\frac{5}{3}$, or $\frac{8}{3}$, of the time to noon is the time from noon to noon again, or 24 hours. $\frac{1}{3}$ of the time to noon is $\frac{1}{8}$ of 24 hours, or 3 hours, and the time to noon, or $\frac{3}{3}$, is 3 times 3 hours, or 9 hours; hence the time is 3 o'clock A. M.

49. The minute-hand passes over twelve spaces while the hour-hand passes over one; hence the minute-hand gains the difference between 12 and 1, or 11, spaces in passing over 12. To gain one space, the distance from 12 to 1 on the dial, it passes over $\frac{1}{11}$ of 12 spaces, which is $\frac{12}{11}$ of a space, or $\frac{12}{11}$ of 5 minutes, which is $5\frac{5}{11}$ minutes, and to gain 2 spaces, the distance the hour-hand is ahead at 2 o'clock, the minute-hand must pass over 2 times $5\frac{5}{11}$ minutes, or $10\frac{10}{11}$ minutes on the dial; hence the hour-hand and the minute-hand are together at $10\frac{10}{11}$ minutes past 2 o'clock.

50. *Sug.* The first part of the solution of this question is similar to that of the 49th. To gain 8 spaces, the minute-hand must pass over 8 times $\frac{12}{11}$, or $8\frac{8}{11}$, spaces, which is equal to $8\frac{8}{11}$ times 5 minutes, or $43\frac{7}{11}$ minutes past 8 o'clock.

51. If the amount of each is reduced \$2000, the amount of both is reduced two times \$2000, or \$4000, which was paid by the third; hence the three paid 3 times \$4000, or \$12000.

52. If 10 remain away, the supper is paid for by the other 30. If the expense of each is increased $\frac{1}{2}$ a dollar,

the expense of the 30 is increased 30 times a half dollar, or 15 dollars, which should have been paid by the 10; hence the expense of each was $\frac{1}{10}$ of 15 dollars, or 1 dollar and a half, and the expense of the supper 40 times $1½, or $60.

53. If the expense of one is increased $1, the expense of 4 is increased 4 times $1, or $4, which should have been paid by the 2; hence each should have paid ½ of $4, or $2. The expense of the coach was therefore 6 times $2, or $12.

Page 323.

54. If ⅗ of the remainder were worth $6, ⅕ of the remainder was worth ⅓ of $6, or $2; and ⅘, or the remainder, were worth 5 times $2, or $10. If the remainder were worth $10, the 30 were worth $20 – $10, or $10. If 30 were worth $10, for $20, or 2 times $10, he bought twice 30, or 60, fowls.

55. If he received $200 for ⅔ of the remainder, he received ½ of $200, or $100, for ⅓ of the remainder, and the whole remainder was worth 3 times $100, or $300; hence the 40 were worth $500 – $300, or $200. If 40 were worth $200, one was worth $\frac{1}{40}$ of $200, or $5, and there were as many sheep as 5 is contained times in 500, or 100.

56. If the hound runs 5 rods while the hare runs 3, he gains 2 rods while running 5; hence, to gain 40 rods, he runs as many times 5 rods as 2 is contained times in 40, or 20 times; hence he runs 20 times 5 rods, or 100 rods.

57. If 4 of the officer's steps equal 6 of the thief's, the officer gains the difference between 6 and 5, or 1, of the thief's steps while running 4 steps; hence, to gain 60 of the thief's, he runs 60 times 4 steps, or 240 steps. The thief runs 5 steps while the officer gains 1; hence, while he gains 60, the thief runs 60 times 5 steps, or 300 steps.

58. The difference between Nora's age and Laura's age is 10 years. At the required time Nora's age equals twice Laura's, or the difference is once Laura's age. Hence, Laura's age at the required time is 10 years. She is now 4 years old; it will therefore require 10 years − 4 years, or 6 years.

59. *Sug.* The difference of their ages is 10 years. At the required time $\frac{1}{2}$ of Edgar's age is the difference; hence, $\frac{1}{2}$ Edgar's age is 10 years, and $\frac{2}{2}$, or his age, is twice 10 years, or 20 years. It will therefore require 20 years − 12 years, or 8 years.

60. *Sug.* The difference of their ages is 3 years. At the required time it is $\frac{2}{3}$ of Mary's age; hence, Mary was $4\frac{1}{2}$ years old, or it was $9 - 4\frac{1}{2}$, or $4\frac{1}{2}$ years ago.

61. NOTE.—This question cannot be solved. It is placed here to test the pupil's skill.

62. The difference equals twice Edgar's age; hence, once Edgar's age equals one-half the difference of their ages, and 12 years hence the difference equals once Edgar's age; therefore, once the difference minus one-half the difference, or one-half the difference, equals 12 years, and the entire difference in the ages is twice 12 years, or 24 years. If twice Edgar's age is 24 years, his age is $\frac{1}{2}$ of 24 years, or 12 years, and his father's age is 3 times 12 years, or 36 years.

63. The difference equals $\frac{2}{3}$ the husband's age; hence, his age is $\frac{3}{2}$ of the difference of their ages, and 10 years later the difference equals $\frac{4}{7}$ of his age; hence, $\frac{1}{7}$ of his age equals $\frac{1}{4}$ of the difference, and $\frac{7}{7}$, or his age, equals $\frac{7}{4}$ of the difference. The difference between $\frac{7}{4}$ the difference and $\frac{3}{2}$ the difference, which is $\frac{1}{4}$ the difference, is 10 years; $\frac{4}{4}$, or the difference, is 4 times 10 years, or 40 years. Since the wife's age is $\frac{1}{3}$ of the husband's, $\frac{2}{3}$ of his age equals

the difference, or 40 years; hence, her age is 20 years, and his is 60 years.

64. The difference is 5 times Mary's age; hence, her age is $\frac{1}{5}$ of the difference; 12 years later her age is once the difference; therefore, 12 years equals once the difference minus $\frac{1}{5}$ of the difference, which is $\frac{4}{5}$ of the difference; $\frac{1}{5}$ of the difference is $\frac{1}{4}$ of 12 years, or 3 years, and $\frac{5}{5}$, or the difference, is 5 times 3 years, or 15 years, which is also 5 times Mary's age. Her age is therefore 3 years, and William's is 18 years.

65. If A furnished 6 and B 9 loaves, they together furnished 15 loaves, and each ate $\frac{1}{3}$ of 15 loaves, or 5 loaves; hence, A furnished 1 loaf more than he ate, and B furnished 4. If C paid 40 cents for 5 loaves, A receives for 1 loaf 8 cents, and B for 4 loaves 4 times 8 cents, or 32 cents.

66. The number of eggs furnished is 7 plus 5 plus 4, or 16. Each eats $\frac{1}{4}$ of 16, or 4, for which D pays 16 cents. 1 egg is worth $\frac{1}{4}$ of 16 cents, or 4 cents. If A furnishes 7 eggs and eats 4, he furnishes for D 3 eggs, and should receive 3 times 4 cents, or 12 cents. If B furnishes 5 eggs and eats 4, he furnishes for D 1 egg, and should receive 4 cents.

67. *Sug.* When the hands are exactly opposite between 4 and 5 o'clock, the minute-hand must gain 4 plus 6, or 10, spaces. If it require $5\frac{5}{11}$ minutes to gain 1 space, to gain 10 spaces will require 10 times $5\frac{5}{11}$ minutes, or $54\frac{6}{11}$ minutes; hence, it is $54\frac{6}{11}$ minutes past 4 o'clock.

PAGE 324.

68. $\frac{7}{7} - \frac{3}{7}$, or $\frac{4}{7}$ of the distance the deer ran, equals 100 rods; $\frac{1}{7}$ of the difference equals $\frac{1}{4}$ of 100 rods, or 25 rods, and $\frac{7}{7}$, or the entire distance, is 7 times 25 rods, or 175 rods.

69. The additional 4 cost the difference between $400 and $300, or $100; hence, 1 cost ¼ of $100, or $25. The first lot, therefore, cost $25 plus $5, or $30, each; and there were as many as 30 is contained times in 300, or 10.

70. If he had sold 3 times as many at the same price, he would have received $600. At 50 cents less each he would have received for them $540. The difference in the price of the whole number is $600 – $540, or $60; hence, there were as many sheep as 50 cents is contained times in $60, or 120 sheep. If 120 sheep is 3 times the number sold, he sold ⅓ of 120 sheep, or 40 sheep, at $5 such.

GENERAL REVIEW.

PAGE 324.

(1.) 6 × $2.25 = $13.50
3 × 1.75 = 5.25
5 × .90 = 4.50
$23.25
6 × $23.25 = $139.50.

(2.) 113 × $82.50 = $9322.50
9322.50 ÷ 75 = 124.3
124.3 A. = 124 A. 48 P.

(3.) 16)16, 96, 240
3)1, 6, 15
1, 2, 5
16 × 3 × 2 × 5 = 480, L. C. M.
2)16, 96, 240
2)8, 48, 120
2)4, 24, 60
2)2, 12, 30
1, 6, 15
2 × 2 × 2 × 2 = 16, G. C. D.
480 ÷ 16 = 30. *Ans.*

(4.) $6 \times \$.33 = \$1.98$

$15 \times .12 = 1.80$

$12 \times .10 = 1.20$

$5 \times .17 = .85$

$12 \times .22 = 2.64$

$1\frac{1}{2} \times .90 = 1.35$

$\$9.82$. *Ans.*

(5.) $17\frac{1}{5}$, $18\frac{1}{4}$, $\frac{14\frac{1}{2}}{3\frac{1}{3}}$

$\frac{14\frac{1}{2}}{3\frac{1}{3}} = \frac{29}{2} \times \frac{3}{10} = \frac{87}{20}$

$\frac{88}{5}$, $\frac{73}{4}$, $\frac{87}{20}$

G. C. D. of 88, 73, 87 = 1

L. C. M. of 5, 4, 20 = 20

$\therefore$ G. C. D. of $17\frac{1}{5}$, $18\frac{1}{4}$, $\frac{14\frac{1}{2}}{3\frac{1}{3}} = \frac{1}{20}$.

(6.) $16\frac{1}{4} = \frac{65}{4}$; $18\frac{1}{5} = \frac{91}{5}$, $\frac{7\frac{1}{2}}{9\frac{1}{3}} = \frac{45}{56}$

L. C. M. of 65, 91, 45 = 4095

G. C. D. of 4, 5, 56 = 1

$\therefore$ L. C. M. of $16\frac{1}{4}$, $18\frac{1}{5}$, $\frac{7\frac{1}{2}}{9\frac{1}{3}} = 4095$.

(7.) $60.325 \times 7.0034 = 422.480105$

$422.480105 \div 3.035 = 139.20267+$.

(8.) 75 A. 10 P. = $75\frac{1}{16}$ A.

$75\frac{1}{16} \times \$165.875 = \$12450.99$.

(9.) 144×7000 gr. = 1008000 gr.

$1008000 \div 5760 = 175$. *Ans.*

(10.) 1 bu. = 2150.42 cu. in.

$\frac{1}{4}$ of 231 cu. in. = 57.75 cu. in. = 1 qt.

$2150.42 \div 57.75 = 37.237$. *Ans.*

PAGE 325.

(11.) $22+25=47$, No. miles apart at end of 1 hour.
36×47 mi. $=1692$ mi.
$1692 \div 60 = 28.2$

$$\begin{array}{l} 28.2^\circ = 28^\circ \ \ 12' \\ \hphantom{28.2^\circ = 28^\circ \ \ 1}4 \\ \hline \text{1 hr. 52 min. 48 sec.} \end{array}$$

(12.)

$$\begin{array}{ll} \text{2 hr.} & \text{15 min.} \\ & 15 \\ \hline 33^\circ & 45' \end{array}$$

(13.)

$$\begin{array}{rll} 100\frac{3}{5}\text{ A.} = & \text{100 A.} & \text{96 P.} \\ 87\frac{1}{2}\text{ A.} = & \text{87 A.} & \text{80 P.} \\ \hline & \text{188 A.} & \text{16 P.} \\ 62\frac{1}{8}\text{ A.} = & \text{62 A.} & \text{20 P.} \\ \hline & \text{125 A.} & \text{156 P.} \end{array}$$

(14.) $10.5 \times 2150.42 = 22579.41$, No. cu. in.
$22579.41 \div 231 = 97.7463$, No. gal.
$97.7463 \times 8 = 781.9704$, No. pt.
$781.9+ \times \$.10 = \$78.19$.

(15.) 6 d. : 40 d. : : 15 men : x.

$$\frac{40 \times 15 \text{ men}}{6} = 100 \text{ men.} \quad \textit{Ans.}$$

(16.)

5 boys do the work in 6 days;
1 boy can do the work in 5×6 days $=30$ days;
Hence 1 boy does $\frac{1}{30}$ in 1 day.
3 men do the work in 6 days;
1 man can do the work in 3×6 days $=18$ days;
Hence 1 man does $\frac{1}{18}$ in 1 day.
5 men can do $\frac{5}{18}$ in 1 day.
3 boys can do $\frac{3}{30}$ in 1 day.

$\frac{5}{18}+\frac{3}{30}=\frac{34}{90}$.
To do $\frac{1}{90}$ requires $\frac{1}{34}$ of a day.
To do $\frac{90}{90}$ requires $90\times\frac{1}{34}$ days $=2\frac{11}{17}$ days.

(17.) $40 : 24 :: 60 : x$.

$$\frac{24\times 60}{40}=36$$

$60-36=24$.

Explanation.—It will keep 24 × 60 fowls, or 1440 fowls, 1 week, and $\frac{1}{40}$ of 1440, or 36, fowls 40 weeks. Hence he sells 60 − 36, or 24.

(18.)
$$\left.\begin{array}{r@{\,:\,}r} 650 & 800 \\ 10 & 12 \\ 3 & 2 \end{array}\right\} :: \$350 : x.$$

$$\frac{800\times 12\times 2\times \$350}{650\times 10\times 3}=\frac{\$4480}{13}=\$344.62.$$

(19.) 10 bu. 3 pk. 1 qt. = 10.78125 bu.
$10.78125\times\$1.60=\$17.25$.

(20.) First + 562 = Second.
First = First.

2 F. + 562 = both = 1750
2 F. = 1750 − 562 = 1188
F. = $\frac{1}{2}$ of 1188 = 594
S. = 594 + 562 = 1156.

(21.) $\frac{2}{3}$ F. = $\frac{3}{5}$ S.
$\frac{1}{3}$ F. = $\frac{1}{2}\times\frac{3}{5}$ S. = $\frac{3}{10}$ S.
$\frac{3}{3}$ F. = $3\times\frac{3}{10}$ S. = $\frac{9}{10}$ S.
$\frac{1}{4}$ Th. = $\frac{1}{6}$ S.
$\frac{4}{4}$ Th. = $4\times\frac{1}{6}$ S. = $\frac{4}{6}$ S.
S. + $\frac{9}{10}$ S. + $\frac{4}{6}$ S. = $\frac{77}{30}$ S.
$\frac{77}{30}$ S. = 1540
$\frac{1}{30}$ S. = $\frac{1}{77}\times 1540=20$
S. = $30\times 20=600$
F. = $\frac{9}{10}\times 600=540$
Th. = $\frac{4}{6}\times 600=400$.

PAGE 326.

(23.) $3\text{ J.} + 60 = 4\text{ S.} - 30$

$3\text{ J.} = 4\text{ S.} - 90$

$\text{J.} = \frac{4}{3}\text{ S.} - 30$

$\underline{\text{S.} = \text{S.}}$

$\text{Both} = \frac{7}{3}\text{ S.} - 30 = 390$

$\frac{7}{3}\text{ S.} = 390 + 30 = 420$

$\frac{1}{3}\text{ S.} = \frac{1}{7}\text{ of } 420 = 60$

$\text{S.} = 3 \times 60 = 180$

$\text{J.} = 4 \times 60 - 30 = 240 - 30 = 210.$

(24.) $140\text{ A. } 20\text{ P.} = 140\frac{1}{8}\text{ A.}$

72% of $140\frac{1}{8}\text{ A.} = 100.89\text{ A.}$

$100.89 \times \$140 = \$14124.60$

$140\frac{1}{8}\text{ A.} - 100.89\text{ A.}$

$= 140.125\text{ A.} - 100.89\text{ A.} = 39.235\text{ A.}$

$39.235\text{ A.} = 39\text{ A. } 37.6\text{ P.}$

$140.125 \times \$120 = \$16815$, Cost.

$\$16815 - \$14124.60 = \$2690.40$

$2690.40 \div 39.235 = 68.57.$ *Ans.*

(25.) $\$590 + \$35 = \$625$, Cost.

$\$820 - \$625 = \$195$, Gain.

12% of $\$195 = \$23.40$

$195 - 23.40 = 171.60$

$171.60 \div 625 = .27\frac{456}{1000}.$ *Ans.*

(26.)
$$\begin{array}{r l}
3 \times \$13 = \$39.00 & \\
.50 & \\
\underline{1.00} & \\
\$40.50, & \text{Cost.} \\
20\% \text{ of } \$40.50 = \underline{8.10} & \\
\$48.60, & \text{Amount received.}
\end{array}$$

$\frac{1}{36}$ of $\$48.60 = \$1.35$, Price.

(27.)

$12\frac{1}{2}\%$ of $\$8000 = \$1000$

$\$8000 + \$1000 = \$9000$, Capital at end of 1st year.

$12\frac{1}{2}\%$ of $\$9000 = \$1125$

$\$9000 + \$1125 = \$10125$, Capital at end of 2d year.

$12\frac{1}{2}\%$ of $\$10125 = \$1265.62$

$\$10125 + \$1265.62 = \$11390.62$, Capital at end of 3d year.

$12\frac{1}{2}\%$ of $11390.62 = 1423.83$

$\$11390.62 + \$1423.83 = \$12814.45$, Capital at end of 4th yr.

$12\frac{1}{2}\%$ of $\$12814.45 = \$1601.81$

$\$12814.45 + \$1601.81 = \$14416.26$, Capital at end of 5th yr.

(28.) $3650 \times \$.32 = \$1168 =$ A's.
$1650.50 \times \$.32 = \$528.16 =$ B's.

(29.) $20\% = \frac{1}{5}$
$\frac{5}{5} + \frac{1}{5} = \frac{6}{5} = 72¢$
$\frac{1}{5} = \frac{1}{6}$ of $72¢ = 12¢$
$\frac{5}{5} = 5 \times 12¢ = 60¢$
$65¢ - 60¢ = 5¢$
$5 \div 60 = 8\frac{1}{3}\%$.

(30.) $100\% - 16\frac{2}{3}\% = 83\frac{1}{3}\% = \frac{5}{6}$
$\frac{5}{6}$ first $= \$125$
$\frac{1}{6}$ first $= \frac{1}{5} \times \$125 = \$25$
$\frac{6}{6}$ first $= 6 \times \$25 = \$150$
Loss $= \$150 - \$125 = \$25$
$100\% + 25\% = 125\% = \frac{5}{4}$
$\frac{5}{4}$ second $= \$125$
$\frac{1}{4}$ " $= \frac{1}{5}$ of $\$125 = \$25$
$\frac{4}{4}$ " $= 4 \times \$25 = \$100$
Gain $= \$125 - \$100 = \$25$.

Hence, he neither gains nor loses.

(31.) $7\frac{1}{4}\% + \frac{1}{8}\% = 7\frac{3}{8}\%$
$100\% + 7\frac{3}{8}\% = 107\frac{3}{8}\%$
$107\frac{3}{8}\%$ of $\$100 = \$107\frac{3}{8}$
$230 \times \$107\frac{3}{8} = \$24696.25$.

(32.) $4\frac{1}{2}\%$ of $\$100 = \$4.50$
$4.50 \div 73 = 6\frac{12}{73}\%$.

PAGE 327.

(33.) $100\% + 14\frac{1}{2}\% = 114\frac{1}{2}\%$
$5 \div 1.14\frac{1}{2} = 4.37$. *Ans.*

(34.) $60 \times \$1.14 = \$68.40$, Currency value of \$1 gold.
$\$68.40 - \$68.00 = \$.40$. *Ans.*

(35.) $100\% + 90\% = 190\%$
$\$147 \div 1.90 = \$77.37$.

(36.) Int. of \$1 at 6% for 3 yr. 3 mo. 3 d. = \$.1905
$620.30 \times \$.1905 = \$118.167+$.

(37.) Int. of \$1 for 5 yr. 6 mo. 5 d. @ 6% = $\$.330\frac{5}{6}$
" " \$173.40 " " $= 173.40 \times \$.330\frac{5}{6} = \$57.3665$
$\frac{1}{6}$ of \$57.3665 = \$9.5619, Int. at 1%.
$7 \times \$9.5619 = \$66.9333$, Int. at 7%.

(38.) $\$30.50 + \$40 = \$70.50$, Expenses.
$\$240 - \$70.50 = \$169.50$, Income from house.
$169.50 \div 2500 = 6.78\%$
$7\% - 6.78\% = \frac{22}{100}\%$. *Ans.*

(39.) 21 yr. − 15 yr. = 6 yr.
$6 \times 5\% = 30\%$
$100\% + 30\% = 130\% = 1\frac{3}{10}$
$1\frac{3}{10}$ A's = amount received at age.

21 yr. − 13 yr. = 8 yr.
$8 \times 5\% = 40\%$
$100\% + 40\% = 140\% = \frac{7}{5}$
$\frac{7}{5}$ B's = amount received at age.
21 yr. − 11 yr. = 10 yr.
$10 \times 5\% = 50\%$
$100\% + 50\% = 150\% = \frac{3}{2}$
$\frac{3}{2}$ C's = amount received at age.
$\frac{13}{10}$ A = $\frac{7}{5}$ B
Hence, A = $\frac{10}{13}$ of $\frac{7}{5}$ B = $\frac{14}{13}$ B.
$\frac{3}{2}$ C = $\frac{7}{5}$ B
Hence, C = $\frac{2}{3}$ of $\frac{7}{5}$ B = $\frac{14}{15}$ B.
$\frac{14}{13}$ B + B + $\frac{14}{15}$ B = $\frac{587}{195}$ B
$\frac{587}{195}$ B = \$23480
$\frac{1}{195}$ B = $\frac{1}{587}$ of \$23480 = \$40
$\frac{195}{195}$ B = 195 × \$40 = \$7800 = 2d.
$\frac{14}{13}$ × \$7800 = \$8400 = 1st.
$\frac{14}{15}$ × \$7800 = \$7280 = 3d.

(40.) Daughter = $6 \times 6\% = 36\%$
$100\% + 36\% = 136\% = \frac{34}{25}$
$\frac{34}{25}$ D's = amount received at age.
Son = $3 \times 6\% = 18\%$
$100\% + 18\% = 118\% = \frac{118}{100}$
$\frac{118}{100}$ S's = amount received at age.
$\frac{118}{100}$ S's = 2 × $\frac{34}{25}$ D's = $\frac{68}{25}$ D's
$\frac{1}{100}$ S's = $\frac{1}{118}$ of $\frac{68}{25}$ D's = $\frac{34}{1475}$ D's
$\frac{100}{100}$ S's = 100 × $\frac{34}{1475}$ D's = $\frac{136}{59}$ D's
$\frac{59}{59}$ D's + $\frac{136}{59}$ D's = $\frac{195}{59}$ D's = \$39000
$\frac{1}{59}$ D's = $\frac{1}{195}$ of \$39000 = \$200
$\frac{59}{59}$ D's = 59 × \$200 = \$11800 = D.
$\frac{136}{59}$ D's = 136 × \$200 = \$27200 = S.

(41.) 6 yr. at $6\% = 36\%$
3 yr. at $10\% = 30\%$
$36\% - 30\% = 6\% = \$300$
$1\% = \frac{1}{6}$ of $\$300 = \$50$
$100\% = 100 \times \$50 = \$5000.$

(42.) 20% of $60¢ = 12¢$
$60 + 12 = 72$
$100\% - 20\% = 80\%$
$1\% = \frac{1}{80}$ of $72¢ = \frac{9}{10}¢$
$100\% = 100 \times \frac{9}{10}¢ = 90¢.$

(43.) $800 \times \$6 = \$4800$
30% of $800 = 240$
$800 - 240 = 560$
$560 \times \$8.50 = \$4760$
$\$4800 - \$4760 = \$40.$ *Ans.*

PAGE 328.

(44.) $\frac{2}{3}$ F. = S.
$\frac{3}{3}$ F. + $\frac{2}{3}$ F. = $\frac{5}{3}$ F. = $3
$\frac{1}{3}$ F. = $\frac{1}{5}$ of $3 = 60¢
$\frac{3}{3}$ F. = $3 \times 60¢ = \$1.80$
S. = $2 \times 60¢ = \$1.20$
$12\frac{1}{2}\% = \frac{1}{8}$
$\frac{8}{8} + \frac{1}{8} = \frac{9}{8} = \$1.80$
$\frac{1}{8} = \frac{1}{9}$ of $\$1.80 = 20¢$, Gain.
$20\% = \frac{1}{5}$
$\frac{5}{5} - \frac{1}{5} = \frac{4}{5} = \$1.20$
$\frac{1}{5} = \frac{1}{4}$ of $\$1.20 = 30¢$, Loss.
Hence, $30¢ - 20¢ = 10¢$, Loss.

(45.) $33\frac{1}{3}\%$ of $\$18 = \$6$
$\$18 - \$6 = \$12$, or $1 each
$\$1.25 - \$1 = 25¢ = 25\%$ of $1.

(46.) $\frac{700\times94\times8}{60\times6}=\$14.62.$ *Ans.*

(47.) $\frac{64\times1}{60}=\$.01\frac{1}{15}$, Discount on \$1.

$\$1-\$.01\frac{1}{15}=\$.98\frac{14}{15}$, Present worth.

$600\div.98\frac{14}{15}=\frac{600\times15}{14.84}=606.47.$ *Ans.*

(48.) $\$3680\div.92=\$4000$
5% of $\$4000=\$200$
$200\div3680=5\frac{10}{23}\%.$

(49.) 6% of $\$100=\$6$
$6\times\$1.15=\$6.90$
$6.90\div.08=86\frac{1}{4}.$ *Ans.*

(50.) 50×144 sq. in. $=7200$ sq. in.
$7200\div\ \ 8\times10=90$
$7200\div10\times12=60$
$7200\div\ \ 9\times16=50$
$7200\div10\times18=40$

(51.) \$3000 for 5 yr. = \$15000 for 1 yr.
\$2000 for 8 yr. = 16000 for 1 yr.
\$5000 for $3\frac{1}{2}$ yr. = 17500 for 1 yr.
\$48500
$14550\div48500=30\%$
30% of $\$15000=\$4500=$ R.
30% of $\$16000=\$4800=$ P.
30% of $\$17500=\$5250=$ L.

(52.) $\overline{60}^2 = 3600$

$\overline{160}^2 = \underline{25600}$

29200

$\sqrt{29200} = 170.88$ *Ans.*

(53.) $\frac{73 \times 72}{4} = \$13.14$, Int.

$\underline{72.00}$, Paid in.

$\$85.14$, Value.

(54.) $\frac{84 \times 85 \times 10}{4 \times 6} = \$29.75$, Int.

$\underline{84.00}$, Paid in.

$\$113.75$, Value.

(55.) $\frac{1}{12}$ of $\$350 = \$29\frac{1}{6}$, Monthly payment.

$\frac{60 \times 61}{4} \times 29\frac{1}{6} = \$266.87\frac{1}{2}$, Int.

$5 \times \$350 = \underline{1750.00}$, Rent.

$\$2016.87\frac{1}{2}$ *Ans.*

PAGE 329.

(56.) $\frac{1}{4}$ of $\$120 = \$30$, Quar. pay.

2 yr. = 8 quarters.

$\frac{8 \times \overset{\text{mo.}}{9} \times 3}{4} = \$.54$

$30 \times \$.54 = \$16.20$, Int.

$2 \times \$120 = \underline{240.00}$, Rent.

$\$256.20$ *Ans.*

(57.) $18 \times 15 = 270$, No. sq. ft. in room.

$3 \times 2\frac{1}{4} = 6\frac{3}{4}$, " " in 1 yd. of carpet.

$270 \div 6\frac{3}{4} = 40$, No. yd.

$40 \times \$2.50 = \$100.$ *Ans.*

(58.)

24 ft. $+ 18$ ft. $+ 24$ ft. $+ 18$ ft. $= 84$ ft., Dis. around room.
$10 \times 84 = 840$, No. sq. ft. surface.
$8 \times 3 \times 1\frac{1}{2} = 36$, No. sq. ft. in 1 roll of paper.
$840 \div 36 = 23\frac{1}{3}$. *Ans.*

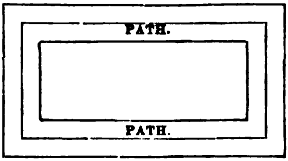
(59.) 15 ft. $\times 13$ ft. $\times 9$ ft. $= 1755$ cu. ft.

(60.) $60 \times 4 \times 6 = 1440$, No. cu. ft.
$1440 \div 128 = 11\frac{1}{4}$, No. cords.
$11\frac{1}{4} \times \$.75 = \$8.44$.

(61.) 31 ft. $\times 16$ ft. $= 496$ sq. ft.
23 ft. $\times 16$ ft. $= \underline{368}$ sq. ft.
864 sq. ft.
864 sq. ft. $\times 5$ ft. $= 4320$ cu. ft.
$4320 \div 27 = 160$
$160 \times \$.25 = \$40$.

(62.) $3.1416 \times R^2 = 3.1416 \times \overline{15}^2 = 706.86$
$15 \times 706.86 = 10602.9$
10602.9×1728 cu. in. $= 18321811.2$ cu. in.
$18321811.2 \div 231 = 79315.2$ gal.
$79315.2 \times 2\frac{1}{2}$¢ $= \$1982.88$.

(63.)



$60 - 6 = 54$, Width from ou
side to outside of path.
$160 - 6 = 154$, Length from outside to outside of path.
$154 \times 54 = 8316$, Area of path and space included.
$60 - 12 = 48$, Width from inside to inside of path.
$160 - 12 = 148$, Length from inside to inside of path.

$148\times48=7104$, Area of space inside of path.
$8316-7104=1212$, Area of path.

(64.) $9\times\frac{12}{11}$ spaces $=\frac{108}{11}$ spaces, distance passed over. $\frac{108}{11}\times5$ min. $=\frac{540}{11}$ min. $=49\frac{1}{11}$ min.

(65.) $\frac{1}{3}+\frac{1}{4}+\frac{1}{5}=\frac{47}{60}$
$\frac{60}{60}-\frac{47}{60}=\frac{13}{60}=390$ bu.
$\frac{1}{60}=\frac{1}{13}$ of 390 bu. = 30 bu.
$\frac{60}{60}=60\times30$ bu. = 1800 bu. *Ans.*

(66.)

At 2 for a cent they are worth $\frac{1}{2}$ cent each.
$60\times\frac{1}{2}$¢ $=30$¢.
At 3 for a cent they are worth $\frac{1}{3}$ cent each.
$60\times\frac{1}{3}$¢ $=20$¢.
If he sell at 5 for 2 cents, he receives for each $\frac{2}{5}$¢.
$60+60=120$, No. apples.
20¢ $+30$¢ $=50$¢, Cost.
$\frac{1}{120}$ of 50¢ $=\frac{5}{12}$¢, Cost of each apple.
$\frac{5}{12}$¢ $-\frac{2}{5}$¢ $=\frac{1}{60}$¢, Loss.
$\frac{1}{60}\div\frac{5}{12}=4\%$.

(67.) $5.00\div80=6\frac{1}{4}\%$
$6.00\div90=6\frac{2}{3}\%$
$6\frac{2}{3}\%-6\frac{1}{4}\%=\frac{5}{12}\%$.

(68.) $5.00\div4.44\frac{4}{9}$
$=500\div\frac{4000}{9}$
$=500\times\frac{9}{4000}=1.12\frac{1}{2}$
$1.12\frac{1}{2}-1=.12\frac{1}{2}=12\frac{1}{2}\%$.

(69.) $\frac{1}{3}\div2\frac{1}{2}=\frac{1}{3}\div\frac{5}{2}$
$\frac{1}{3}\div\frac{5}{2}=\frac{1}{3}\times\frac{2}{5}=\frac{2}{15}$
$\frac{2}{15}$ of $100\%=13\frac{1}{3}\%$.

(70.) $40 \times \$15 = \$600$, Cost.
$40 \times \$16 = \$640$, Selling price.
$\$640 \times .03 = \$19.20$, Discount.
$\$640 - \$600 = \$40$, Gain.
$\$40 - \$19.20 = \$20.80$, Gain.

PAGE 330.

(71.)

A and B do $\frac{2}{25}$ in a day.
B and C do $\frac{1}{15}$ in a day.
A and C do $\frac{1}{14}$ in a day.

$2(A, B, C) = \frac{2}{25} + \frac{1}{15} + \frac{1}{14} = \frac{229}{1050}$, Twice what all do in a day.
$\frac{1}{2}$ of $\frac{229}{1050} = \frac{229}{2100}$, What all can do in a day.
$\frac{229}{2100} - \frac{2}{25} = \frac{61}{2100}$ = What C does in a day.
$\frac{2100}{2100} \div \frac{61}{2100} = 34\frac{26}{61}$ = C.
$\frac{229}{2100} - \frac{1}{15} = \frac{89}{2100}$ = What A does in a day.
$\frac{2100}{2100} \div \frac{89}{2100} = 23\frac{53}{89}$ = A.
$\frac{229}{2100} - \frac{1}{14} = \frac{79}{2100}$ = What B does in a day.
$\frac{2100}{2100} \div \frac{79}{2100} = 26\frac{46}{79}$ = B.

(72.) $\$2950 - \$750 = \$2200$, Gain of B. and W.
$\$6000 + \$5000 = \$11000$, Capital of B. and W.
$2200 \div 11000 = 20\%$, Gain.
20% of $\$6000 = \$1200$, Boggis's gain.
20% of $\$5000 = \$1000$, Wilson's gain.
$\$750 = 20\%$ of Bittner's capital.
$\frac{1}{5} = \$750$
$\frac{5}{5} = 5 \times \$750 = \$3750$, Bittner's capital.

(73.) $\frac{1}{4}$ B's $= \frac{2}{5}$ A's
B's $= 4 \times \frac{2}{5}$ A's $= \frac{8}{5}$ A's
$\frac{8}{5}$ A's $- \frac{5}{5}$ A's $= \frac{3}{5}$ A's $= 126$
$\frac{1}{5}$ A's $= \frac{1}{3}$ of $126 = 42$
A's $= 5 \times 42 = 210$
$210 + 126 = 336$ = B's.

(74.) $786 \div 5240 = 15\%$, Gain.

$\$45 = 15\%$ of $\$300$

Hence W.'s capital = C.'s + \$300

$$\begin{array}{l}
\text{C.'s} + 300 = \text{W.'s.} \\
\underline{\text{C.'s} \qquad = \text{C.'s.}} \\
2\ \text{C.'s} + 300 = 5240 \\
2\ \text{C.'s} = 5240 - 300 = 4940 \\
\text{C.'s} = \tfrac{1}{2} \text{ of } 4940 = 2470 \\
\text{W.'s} = 300 + 2470 = 2770.
\end{array}$$

(75.) $120 \times 10 = 1200$, No. sq. ft.

$1200 \times 144 = 172800$, No. sq. in.

$8^2 = 64$

$172800 \div 64 = 2700$, No. 8-inch.

$10^2 = 100$

$172800 \div 100 = 1728$, No. 10-inch.

(76.) 1 yr. 6 mo. = 18 mo.

$\$3.22 \times .09 = \$.2898$, Int. on \$3.22 for $1\frac{1}{2}$ yr.

$\$3.22 + \$.2898 = \$3.5098$, Cost.

$\$3.5098 - \$3.50 = \$.0098 = 9.8$ mills.

(77.) $$\frac{20 \times 21 \times 12}{4} = \$12.60$$

$$\begin{array}{lll}
48.53 \times \$12.60 & = & \$611.478, \text{ Int.} \\
20 \times \$48.53 & = & \underline{\ \ 970.600}, \text{ Payments.} \\
 & & 1582.078 \\
 & & \underline{1000.\qquad} \\
 & & \$582.078, \text{ Loss.}
\end{array}$$

(78.) 2 ft. 6 in. : 90 ft. : : 4 ft. : x.

$$\frac{90 \times 4}{2\frac{1}{2}} = 144. \quad \textit{Ans.}$$

(79.) 12 wk. = 72 d.
$72 \times \$1.25 = \$90$, Amt. he should have saved.
$\$90 - \$80.40 = \$9.60$, Lost by idleness.
$\$1.25 + \$.35 = \$1.60$, Loss per day.
$9.60 \div 1.60 = 6$, No. days idle.

(80.) $100\% + 20\% = 120\%$, Manufac. price.
20% of $120\% = 24\%$
$120\% + 24\% = 144\%$, Jobber's price.
25% of $144\% = 36\%$
$144\% + 36\% = 180\%$, Retail.
$180\% = \frac{9}{5} = \$1.08$
$\frac{1}{5} = \frac{1}{9}$ of $\$1.08 = 12$¢
$\frac{5}{5} = 5 \times 12$¢ $= 60$¢, Cost.

(81.) The pile equals $\frac{1}{4}$ of a cone.
$3.1416 \times R^2 =$ area of base.
$3.1416 \times 5^2 = 785.4$
$\frac{1}{3} \times 6 \times 785.4 = 157.08$
$\frac{1}{4}$ of $157.08 = 39.27$, cu. ft. in pile.
$.8 \times 39.27 = 31.416$. *Ans.*

(82.) 6 ft. 8 in. $= \frac{20}{3}$ ft. = slant height, or hypothenuse.
4 ft. = perpendicular height.
$(\frac{20}{3})^2 - (4)^2 = \frac{400}{9} - 16 = \frac{256}{9}$
$\sqrt{\frac{256}{9}} = \frac{16}{3} = R.$
$3.1416 \times (\frac{16}{3})^2 = 89.3610\frac{2}{3}$, Area of base.
$\frac{1}{3}$ of $4 \times 89.3610\frac{2}{3} = 119.1480\frac{8}{9}$, Contents of cone.
$\frac{1}{2}$ of $119.1480\frac{8}{9} = 59.5740\frac{4}{9}$, No. cu. ft. in pile.
$59.5740\frac{4}{9} \times .8 = 47.65923\frac{5}{9}$, No. bushels.
$47.65923\frac{5}{9} \times \$1.25 = \$59.574$. *Ans.*

(83.) $250 \times 2150.42 = 537605$
$\sqrt[3]{537605} = 81 +$ in. = 6 ft. 9 in.

(84.) $.75 × .36 = 27¢, Int. on 75¢ for 6 yr. at 6%.
75 + 27 = 102
$1.02 − $1 = $.02.

(85.) 66 yr. − 16 yr. = 50 yr.

$$\frac{50 \times 51 \times 12}{4} = \$76.50, \text{ Int. on } \$1, \text{ payable annually.}$$

365 × 10¢ = $36.50, Annual payment.
$36.50 × 76.50 = $2792.25, Int.
$36.50 × 50 = 1825.00, Saved.
$4617.25, Total.

(86.) $\$1 \times (1.06)^{19} = \$3.0256$, Amount of $1 for 20 yr. at 6% comp. int.

$$\frac{\$3.0256 \times 1.06}{.06} - \$1 = \frac{\$2.2071}{.06}$$

= $36.785, Final value of $1.
30 × $36.785 = $1103.55. *Ans.*

NOTE.—This answer is found by using the comp. int. table; the answer in the book, $1103.57, is found by carrying out the decimals.

(87.) $\frac{1}{2}$ of 30 = 15, Base.
$8^2 + 15^2 = 289$
$\sqrt{289} = 17$
17 ft. + 2 ft. = 19 ft. *Ans.*

(88.) A = 30
B = 30
C = 30
D = 18
E = 12
120 miles for $15.
15 ÷ 120 = $.12$\frac{1}{2}$, Cost of riding 1 mile.
30 × $.12$\frac{1}{2}$ = $3.75, A, B, C, respectively.
18 × $.12$\frac{1}{2}$ = $2.25 = D.
12 × $.12$\frac{1}{2}$ = $1.50 = E.

(89.) The estate should be divided in the proportion of $\frac{1}{4}$ to $\frac{5}{12}$.

$$\frac{1}{4}+\frac{5}{12}=\frac{8}{12}=20000$$
$$\frac{1}{12}=\frac{1}{8}\text{ of }20000=2500$$
$$\frac{3}{12}=3\times2500=7500\text{, Daughter.}$$
$$\frac{5}{12}=5\times2500=12500\text{, Son.}$$

(90.) $\frac{1}{3}\,(\text{A.}+80\text{ ft.})=16\text{ G.}+6\text{ ft.}$

$$\begin{array}{l} \text{A.}+80\text{ ft.}=48\text{ G.}+18\text{ ft.} \\ \text{A.}+62\text{ ft.}=48\text{ G.} \\ \text{or } 48\text{ G.}-62\text{ ft.}=\text{A.} \\ \qquad\text{G.}\qquad\qquad=\text{G.} \\ \hline 49\text{ G.}-62\text{ ft.}=\text{both}=134\text{ ft.} \\ 49\text{ G.}=134\text{ ft.}+62\text{ ft.}=196\text{ ft.} \\ \quad\text{G.}=\frac{1}{49}\text{ of }196\text{ ft.}=4\text{ ft.} \\ \quad\text{A.}=134\text{ ft.}-4\text{ ft.}=130\text{ ft.} \end{array}$$

(91.) $37.80\div100=.378$

$$378\left\{\begin{array}{c|c|c|c|c} 450 & \frac{1}{72} & & \frac{1}{72} & 3 \\ 270 & & \frac{1}{108} & \frac{1}{108} & 2 \end{array}\right\}20=\left\{\begin{array}{c} 60 \\ 40 \end{array}\right.$$

(92.) $\text{H.}=16\text{ oz.}$

$$\begin{array}{l} \text{T.}=16\text{ oz.}+\frac{1}{4}\text{ B.} \\ \hline \qquad 32\text{ oz.}+\frac{1}{4}\text{ B.}=\frac{1}{2}\text{ B.} \\ 2\,(32\text{ oz.}+\frac{1}{4}\text{ B.})=\text{B.} \\ =64\text{ oz.}+\frac{1}{2}\text{ B.}=\text{B.} \\ \text{B.}-\frac{1}{2}\text{ B.}=\frac{1}{2}\text{ B.}=64\text{ oz.} \end{array}$$

$$\begin{array}{lll} \text{B.} & =2\times64\text{ oz.} & =128\text{ oz.} \\ \text{T.} & =16\text{ oz.}+32\text{ oz.}= & 48\text{ oz.} \\ \text{H.} & = & \underline{16}\text{ oz.} \\ \text{Fish} & = & 192\text{ oz.}=12\text{ lb.} \end{array}$$

(93.) $\frac{1}{3}$ d. + $\frac{1}{5}$ d. = $\frac{8}{15}$ d., Cost of 2 apples.

$\frac{1}{2}$ of $\frac{8}{15}$ d. = $\frac{4}{15}$ d., Cost of 1 “

2 for 5¢ = 4 for a dime, or $\frac{1}{4}$ d. each = selling price.

$\frac{4}{15}$ d. − $\frac{1}{4}$ d. = $\frac{1}{60}$ d., Loss on each.

(94.) $\$540-\$300=\$240$, Second received.
$\frac{3}{4}$ of $\$240=\$180$, Amount first would have received had he worked $\frac{3}{4}$ as long as the second.
$\$300-\$180=\$120$, Pay for 40 days.
$\frac{1}{40}$ of $\$120=\$3$, Pay for 1 day.
$\$300\div\$3=100$, No. days first worked.
$\$240\div\$3=\ 80$, " " second "

(95.)

$\frac{6}{6}-(\frac{1}{6}+100)=\frac{5}{6}-100=$ Rem.
$\frac{1}{5}$ of $(\frac{5}{6}-100)+120=\frac{1}{6}-20+120=\frac{1}{6}+100$, to John.
$(\frac{5}{6}-100)-(\frac{1}{6}+100)=\frac{4}{6}-200=$ Rem.
$\frac{1}{4}$ of $(\frac{4}{6}-200)+150=\frac{1}{6}-50+150=\frac{1}{6}+100$, to George.
$(\frac{4}{6}-200)-(\frac{1}{6}+100)=\frac{3}{6}-300=$ Rem.
$\frac{1}{3}$ of $(\frac{3}{6}-300)+400=\frac{1}{6}-100+400=\frac{1}{6}+300$, to Silas.
$(\frac{3}{6}-300)-(\frac{1}{6}+300)=\frac{2}{6}-600=\frac{2}{15}$ of the money.
$\frac{1}{15}$ money $=\frac{1}{2}$ of $(\frac{2}{6}-600)=\frac{1}{6}-300$
$\frac{15}{15}$ " $=15$ times $(\frac{1}{6}-300)=\frac{15}{6}-4500$
$\frac{15}{6}-4500=\frac{6}{6}$
$\frac{15}{6}-\frac{6}{6}=\frac{9}{6}=4500$
$\frac{1}{6}=\frac{1}{9}$ of $4500=500$
$\frac{6}{6}=6\times500=3000$. *Ans.*

(96.) E. $=\frac{1}{3}$ F.
E. + 12 yr. $=\frac{1}{2}$ (F. + 12 yr.)
$=\frac{1}{2}$ F. + 6 yr.
E. + 12 yr. $=\frac{1}{3}$ F. + 12 yr.
$\frac{1}{2}$ F. + 6 yr. $=\frac{1}{3}$ F. + 12 yr.
$\frac{1}{2}$ F. $-\frac{1}{3}$ F. or $\frac{1}{6}$ F. $=12$ yr. -6 yr. $=6$ yr.
$\frac{6}{6}$ F. $=6\times6$ yr. $=36$ yr.
36 yr. + 10 yr. = 46 yr. = Father's age now.
E. $=\frac{1}{3}$ F. $=\frac{1}{3}$ of $36=12$
12 yr. + 10 yr. = 22 yr., Edwin's age now.

(96.)* Father's age = 3 Edwin's age.
2 E. = Difference of ages.
E. = $\frac{1}{2}$ Difference.
E. = 1 Difference 12 yr. later.
Hence, 1 Dif. − $\frac{1}{2}$ Dif. = $\frac{1}{2}$ Dif. = 12 yrs.
Dif. = 2 × 12 yr. = 24 yr.
2 Edwin's age = 24 yrs.
1 " " = 12 yrs., 10 yrs. ago.
12 + 10 = 22, his age now.

PAGE 333.

(97.) 100% + 25% = 125%
10% of 125% = 12$\frac{1}{2}$%
125% − 12$\frac{1}{2}$% = 112$\frac{1}{2}$%
112$\frac{1}{2}$% − 100% = 12$\frac{1}{2}$%. *Ans.*

(98.) 1st watch = $60
2d watch + chain = 2 × $60 = 120
Both watches and chain = $180
1st watch and chain = $\frac{5}{4}$ 2d watch.
$\frac{5}{4}+\frac{4}{4}=\frac{9}{4}$ = $180
$\frac{1}{4}=\frac{1}{9}$ of $180 = $20
$\frac{4}{4}$ = 4 × $20 = $80 = 2d watch.
$120 − $80 = $40, Chain.

(99.) 2 lb. salt to 100 lb. mixture.
1 " " " 50 lb. "
5 " " 5 × 50 lb. = 250 lb.
250 lb. − 60 lb. = 190 lb. *Ans.*

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* Two solutions are given; the student may choose.

(100.)

$\overline{13}^2 = 169$

$169 \times .785398 = 132.732262$, Area of top in sq. in.

$(8\frac{1}{2})^2 = 72.25$

$72.25 \times .785398 = 56.74500550$, Area of bottom in sq. in.

$132.732262 \times 56.74500550 = 7531.892937217441$

$\sqrt{7531.892937217441} = 86.786479$, Middle area in sq. in.

$$\begin{array}{r} 132.732262 \\ 56.7450055 \\ 86.786479 \\ \hline 276.2637465 \end{array}$$

276.2637465, Sum of areas.

$\frac{1}{3}$ of $8\frac{1}{2} = \frac{17}{6}$

$\frac{17}{6} \times 276.2637465 = 782.74728175$, Contents in cu. in.

1 qt. $= \frac{1}{4}$ of 231 cu. in. $= 57.75$ cu. in.

$782.74728175 \div 57.75 = 13.554$ qts. $= 13$ qt. 1.1 pt.

THE END.

KEY TO THE APPENDIX.

PAGE 337.—CASE I.

(2.) 5 yr. 6mo. = 66 mo.
66 × 10 × $1 = $660. *Ans.*

(3.) $7\frac{1}{2}$yr. = 90 mo.
90 × 5 × $1 = $450, Cost of first series.
$5\frac{1}{2}$ yr. = 66 mo.
66 × 10 × $1 = $660, Cost of second series.
$450 + $660 = $1110. *Ans.*

(4.) 6 yr. 7 mo. = 79 mo.
79 × 12 × $1 = $948, Cost of stock.
$12 × .02 = 24¢, Monthly fine.
3 × 24¢ = 72¢, Total fines.
$948 + 72¢ = $948.72. *Ans.*

CASE II.

(2.) ($.10 + $.40) 2 = $1.00, Fine on 1 share.
12 × $1 = $12, Fine on 12 shares.
4 × 12 × $1 = $48, Dues on 12 shares.
48 + $12 = $60. *Ans.*

(3.) (6¢ + 18¢) $1\frac{1}{2}$ = $.36, Fine on $1 payable monthly.
10 × $.36 = $3.60, Total fine.
3 × 10 × $1 = $30, Total dues.
$30 + $3.60 = $33.60, Total arrears.

(4.) 9 yr. 7 mo. = 115 mo.
$115 \times 6 \times \$1 = \$690$, Total dues.
$\$6 \times .10 = 60¢$, Monthly fine.
$3 \times 60¢ = \$1.80$, Total fines.
$\$690 + \$1.80 = \$691.80$, Amount paid.

PAGE 338.

(5.) 10 yr. 3 mo. = 123 mo.
$123 \times \$1 = \$123$, Dues paid on each share.
$(\$.10 + \$.40)\,2 = \$1$, Fine on each share.
$\$123 + \$1 = \$124$, Cost of each share.
$\$200 - \$124 = \$76$, Net gain on each share.
$8 \times \$76 = \$608$, Total gain.

CASE III.

(2.) 5 yr. = 60 mo.
$*\frac{60 \times 61}{4} = 915$, or \$9.15 = Interest on 1 share.
\$60, dues, + \$9.15, int. = \$69.15, Value of each share.
$7 \times \$69.15 = \$484.05$. *Ans.*

(3.) 8 yr. 3 mo. = 99 mo.
$\frac{99 \times 100 \times 10}{4 \times 6} = 4125$, or \$41.25, Int. on 1 share at 10%.
$\$99 + \$41.25 = \$140.25$, Value of 1 share.
$4 \times \$140.25 = \$561$. *Ans.*

REMARK.—The formula $\frac{99 \times 100}{4}$ gives the interest at 6%; dividing by 6, gives the interest at 1%; and multiplying by 10, gives the interest at 10%.

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* See COMPLETE ARITHMETIC, Art. 309, page 286.

(4.) 8 yr. 6 mo. = 102 mo.

$\frac{102\times103\times10}{4\times6}=4377\frac{1}{2}$, or $\$43.77\frac{1}{2}$, Int. on 1 share.

$\$102+\$43.77\frac{1}{2}=\$145.77\frac{1}{2}$, Value of 1 share, 1st series.

$6\times\$145.77\frac{1}{2}=\$874.65$, Value of 6 shares, 1st series.

5 yr. 6 mo. = 66 mo.

$\frac{66\times67\times8}{4\times6}=1474$, or \$14.74, Interest on 1 share.

\$66 + \$14.74 = \$80.74, Value of 1 share, 4th series.

10 × \$80.74 = \$807.40, Value of 10 shares, 4th series.

\$874.65 + \$807.40 = \$1682.05, Total value of stock.

PAGE 339.—CASE IV.

(2.) 8 yr. = 96 mo.

\$200 − \$96 = \$104, Net gain.

$\frac{96\times97}{4\times6}=388$, or \$3.88, Net gain at 1% for the time.

\$104 ÷ \$3.88 = 26.8, or 26.8%. *Ans.*

(3.) 12 yr. = 144 mo.

\$200 − \$144 = \$56, Net gain.

$\frac{144\times145}{4\times6}=870$, or \$8.70, Net gain at 1%.

\$56 ÷ \$8.70 = 6.44, or 6.44%. *Ans.*

(4.) 10 yr. 8 mo. = 128 mo.

\$200 − \$128 = \$72, Net gain.

$\frac{128\times129}{4\times6}=688$, or \$6.88, Net gain at 1%.

\$72 ÷ \$6.88 = 10.46, or 10.46%. *Ans.*

(5.) 9 yr. 8 mo. = 116 mo.

$\$200 - \$116 = \$84$, Net gain.

$\frac{116 \times 117}{4 \times 6} = 565\frac{1}{2}$, or $\$5.65\frac{1}{2}$, Net gain at 1%.

$\$84 \div \$5.65\frac{1}{2} = 14.85$, or 14.85%, Gain per cent.

$6 \times \$84 = \$504$, Cash gain.

(6.) 7 yr. = 84 mo.

$\$152.10 - \$84 = \$68.10$, Net gain.

$\frac{84 \times 85}{4 \times 6} = 297\frac{1}{2}$, or $\$2.97\frac{1}{2}$, Net gain at 1%.

$\$68.10 \div \$2.97\frac{1}{2} = 22.9$, or 22.9%. *Ans.*

CASE V.

(2.) $\$2000 \times .35 = \$700$, Gross premium.

$6 \times 10\% = 60\%$.

$\$700 \times .60 = \$420$, Discount.

$\$700 - \$420 = \$280$, Net premium.

$\$2000 - \$280 = \$1720$, Net loan.

PAGE 340.

(4.) $\$200 - \$125.10 = \$74.90$, Unearned value.

$\frac{74.90}{200.00}$ of $\$84 = \$31.453$, Equitable premium.

(5.) $\$3000 \times .37\frac{1}{2} = \$1125$, Gross premium.

$2 \times 10\% = 20\%$.

$.20 \times \$1125 = \$225$, Discount.

$\$1125 - \$225 = \$900$, Net premium.

$\$3000 - \$900 = \$2100$, Net loan.

(6.) $\$4000 \times .35\frac{1}{2} = \$1420$, Gross premium.
$3 \times 10\% = 30\%$.
$.30 \times \$1420 = \$426$, Discount.
$\$1420 - \$426 = \$994$, Net premium.
$\$4000 - \$994 = \$3006$, Net loan.
3 yr. 6 mo. = 42 mo.
$42 \times 20 \times \$1 = \$840$, Paid in before loan.
9 yr. 8 mo. = 116 mo.
116 mo. − 42 mo. = 74 mo.
$\$20 + \$20 = \$40$, Dues and interest monthly.
$74 \times \$40 = \$2960$, Paid in after loan.
$\$2960 + \$840 = \$3600$, Total paid in.

PAGE 341.—CASE VI.

(2.) $\$800 - \$160 = \$640$, Net loan.
5 yr. 4 mo. = 64 mo.
$\frac{64 \times 65}{4} = 1040$, or \$10.40, Int. on dues at 6% at time of loan.
$\$64 + \$10.40 = \$74.40$, Value of stock at 6%.
$4 \times \$74.40 = \$297.60$, Value of 4 shares of stock.
$\$640 - \$297.60 = \$342.40$, Actual value of loan.
10 yr. − 5 yr. 4 mo. = 4 yr. 8 mo. = 56 mo., Time loan is held.
$56 \times \$8 = \$448$, Payments on loan for 56 mo.
$\frac{55 \times 56}{4} = 770$, or \$7.70, Int. on \$1 payable monthly.
$8 \times \$7.70 = \$61.60$, Interest on payments.
$\$448 + \$61.60 = \$509.60$, Value of money paid on loan.
$\$509.60 - \$342.40 = \$167.20$, Int. paid in 56 mo.
$\$167.20 \div \frac{56}{12} = \$35.83$, Average interest per year.
$\$35.83 \div \$342.40 = 10.5\%$. *Ans.*

(3.) $1000 – $315 = $685, Net loan.

1 yr. 6mo. = 18 mo.

$\frac{18 \times 19}{4} = 85\frac{1}{2} = \$.85\frac{1}{2}$, Int. on dues at 6% at time of loan.

$18 + $.85½ = $18.85½, Value of stock at time of loan.

5 × $18.85½ = $94.27½, Value of 5 shares of stock.

$685 – $94.27½ = $590.72½, Actual value of loan.

9 yr. – 1 yr. 6 mo. = 7 yr. 6 mo. = 90 mo.

90 × $10 = $900, Payments on loan for 90 mo.

$\frac{89 \times 90}{4} = 2002\frac{1}{2}$, or $20.02½, Interest on $1 payable monthly.

10 × $20.02½ = $200.25, Interest on payments.

$900 + $200.25 = $1100.25, Value of money paid on loan.

$1100.25 – $590.72½ = $509.52½, Int. paid in 90 mo.

$509.52½ ÷ $\frac{90}{12}$ = $67.937, Average interest per year.

$67.937 ÷ $590.725 = 11.5%. *Ans.*

PAGE 342.—CASE VII.

(3.) $84 – $48 = $36, Gross gain.

$\frac{48 \times 49}{4} = 588$, or $5.88, Gain at 6%.

$36 – $5.88 = $30.12, Surplus.

$\frac{84}{200}$ × $30.12 = $12.65, Equitable share of surplus.

$12.65 + $5.88 = $18.53, Adjusted profits.

10% of $18.53 = $1.853, Profits retained.

$18.53 – $1.853 = $16.677, Withdrawal profit.

$48 + $16.677 = $64.677, Withdrawal value of 1 share.

6 × $64.677 = $388.062, Withdrawal value of 6 shares.

$\frac{41}{100}$ × $384 = $157.44, Premium retained.

$384 – $157.44 = $226.56, Premium returned.

$388.062 + $226.56 = $614.622, Value of shares with premium.

$1200 – $614.622 = $585.37 +. *Ans.*

(4.) $130 – $84 = $46, Gross gain.

$\frac{84 \times 85}{4} = 1785$, or $17.85, Gain at 6%.

$46 – $17.85 = $28.15, Surplus.

$\frac{130}{200} \times$ $28.15 = $18.2975, Equitable share of surplus.

$18.2975 + $17.85 = $36.1475, Adjusted profits.

10% of $36.1475 = $3.61475, Profits retained.

$36.1475 – $3.61475 = $32.53275, Withdrawal profit.

$84 + $32.53275 = $116.53275, Withdrawal value of 1 share.

5 × $116.53275 = $582.66375, Withdrawal value of 5 shares.

.76 × $340 = $81.60, Premium returned.

$582.66375 + $81.60 = $664.26375, Value of shares and premium.

$1000 – $664.26375 = $335.736 +. *Ans.*